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THE BRICKBUILDER

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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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THE STRENGTH OF A BRICK.

IT is so seldom in modern practise that masonry of any sort is loaded anywhere near to its limit, that we are apt to forget how large a factor of safety has come to be considered wise, and how little real reliance is placed upon the innate strength of the units which go to make up the masonry walls. There have been a few cases on record where brickwork has been actually crushed by a load unwisely placed upon it in a building, but, generally speaking, the kind of brick that is considered advisable for use has practically a resistance to crushing so great that the determining factor in the designing of a wall or pier is not the strength of the unit, but rather the lateral stability of the completed structure. Indeed, measured by any tests which we can apply, the most ordinary sort of light hard brick has sufficient strength to satisfy the mere letter of even the most exacting building law. This was brought to our notice very clearly a short time since by some tests which were made by Norcross Brothers, the well-known builders, in connection with the construction of one of the large buildings in this city. A selection was made of a number of different qualities of brick, ranging from what would be termed a rather indifferent light hard up to a thoroughly hard burned dark brick equal to the best quality which is manufactured. The tests were upon a half brick only, the loaded area averaging about 15 sq. ins. A record was kept of the load which produced the first crack in the material, as well as the ultimate crushing strength per square inch. The former ran from 2,720 lbs. per square inch for the poorest of the bricks up to 8,000 lbs. per square inch for the best quality, while the ultimate strength ran from 3,149 lbs. per square inch for the poorest sample up to 10,532 per square inch for the hardest. Or, reduced to tons per square foot, this means that the poorest sort of brick cracked under the equivalent of a load of nearly 196 tons per square foot with an ultimate strength of 226 tons per foot, while the best sample cracked under 576 tons a foot, and only yielded under an ultimate strain of a little over 758 tons per foot. When we consider that the utmost that the building laws of most of our large cities consider as safe is a strain of 15 tons per square foot on masonry walls laid up in cement mortar, this unit strain, as compared with the ultimate resistance of the poorest of these bricks of 220 tons per foot, allows for a factor of safety of nearly 15, while in the case of the hardest bricks the factor is over 50.

Now we would not argue from this that it is perfectly safe to use light hard bricks, or that the wise builder can save the difference in cost between a good and an indifferent brick and secure just as good a building. As we stated in the beginning of the preceding paragraph, the strength of a wall is not wholly measured by the resistance of the units of which it is composed, but rather by the stability of the whole. Our modern methods of scientific analysis have enabled us sometimes to shade construction within some pretty perilously close scientific limits, and we cannot afford to take the chances of poor workmanship or unexpected concentrated loads and trust to anything but the best bricks for a first-class building. Still it is a satisfaction to the architect or constructor who is at the mercy of a careless or indifferent workman to know that if a brick pier is built up reasonably well, the material itself is innately so strong that there is very little risk of failure.

In this connection we recall the case of a large building erected some distance from Boston in which by an oversight the piers supporting an enormously heavy tower were built of a size which seemed so small as to arouse the fears of a constructor, who, to set his mind at rest, made some practical experiments on piers of the full size of the ones in the building, constructed in the same manner, which he loaded to destruction after having allowed ample time for a good hard set on the mortar. We have not the figures at hand which give the crushing strength of the pier, but as a result of these experiments, the builder felt there was not the slightest risk in loading good brick piers to 25 tons per square foot.

VALUABLE HIGHWAY.

WE were all much interested in the shrewd scheme which found so many supporters a short time since to extract gold from sea water. A no less subtle swindle betrayed many people a few months ago, which claimed to work the precious metal out of the dust of our streets; but an enterprise which seems quite as unreasonable was to dig diamonds out of macadamized roads. This is actually what took place some time since at Kimberley, in South Africa, where formerly existed a road which could fairly be quoted as the most valuable highway in the world. It was built out of the blue clay deposit taken from the diamond mines at a period before the consolidation of the companies, and upon investigation

was found to be so thickly studded with diamonds that by improved processes of separation millions' worth of gems were taken from it. We always knew that clay was a good thing.

CARVED BRICK.

WE are sorry to see an indication of a possible revival of carved brickwork as an ornament to the building. While having the utmost confidence in burnt clay as a medium of expressing the highest ideals in architecture, we also feel that every material has its legitimate use, and that the time will never come when burnt clay in any form can be treated like stone. To cut away the surface of brick or terra-cotta is to destroy its distinctive character, to lay bare its weakest sides, and to attempt a cheap imitation of what can be done far better in stone. We do not need to imitate another material in order to get the best results out of brick.

A LESSON FROM A BUILDING ACCIDENT.

IN one of our Western cities, last spring, a building partially collapsed through the failure of a brick pier, and as the form of construction there employed is quite common, a description of the "accident" may be instructive to the readers of this journal.

The building was of three stories, with a flat roof, and built on an inside lot, of 25 ft. frontage. The first story was intended for stores, and the upper stories for lodging rooms. To give light and ventilation to the rooms in the second and third stories, an area was formed at one side of the building, about 4 ft. 6 ins. deep and 41 ft. long. The walls of this area were of brick and rested on steel beams, placed about flush on top, with the second story floor joists, and framed as in Fig. 1. There were no posts in the first story; the longitudinal beams being supported by the cross beams, A, B, C. The wall WW and the pier P extended only to about the level of the second floor. The area was roofed over the store by a skylight, and the weight of this skylight was all that came upon the walls at WW, the walls being practically curtain walls. The pier P, however, was required to support the end of beams BB. From the bottom of the beams to the first floor was about 11 ft. 4 ins. The walls and pier were built and bonded together.

About five o'clock, one afternoon, the steel beams, and the portion of the building supported by them, suddenly fell to the cellar without warning. A few minutes before, the owner of the building was in the cellar, where the accident occurred, but at the time of the accident the building was fortunately vacant.

The second and third stories had just been rough plastered (brown coated), but not the first story. The only weight on the beams and walls was that of the material used in the construction of the building, which could be closely computed.

After the collapse, the beam A was found broken short off (with a clean fracture) where the beams D were framed into it, and the broken end of the short piece was embedded in the cellar floor, the wall end being in the air. The wall end of the long piece was pulled out of the wall, but the piece was leaning against the wall with the broken end on the cellar floor.

The end of beams BB, which had been on pier P, were resting on the cellar floor, and the other end against the opposite wall. Beam C remained in position, but was badly twisted. Most of the connections were more or less broken, but the longitudinal and cross beams were not wholly disconnected.

About 5 ft. of the upper portion of the pier P was thrown down, making a hole in the wall from 4 to 5 ft. long, part of the bricks being on the outside of the wall and part on the inside. The rest of the wall was not apparently injured.

The actual loads on the beams, at the time of the accident, as near as can be computed, were 20 tons at point X, Fig. 1, and 38.3 tons at point Y. This is just about the safe load for the beams. The load transmitted to the pier P by the ends of beams BB would be 30.75 tons, or 7.23 tons per square foot, the pier itself being 3 ft. long and 17 ins. thick, with a hard laminated stone on top the full size of the pier. The beams BB rested on the stone template as shown in Fig. 2.

Owing to the broken end of the beam A being buried in the ground, it looked at the first inspection of the ruin as though the beam had broken from some defect in the steel, although the fracture had the same appearance as the broken edges of the connecting angles.

When the beams A and C were removed from the rubbish, however, they were found to be bent horizontally, about as shown in Fig. 3, while there was practically no deflection vertically. This points very decidedly to the conclusion that the pier P must have failed first, and the sudden jerk on beams A and C, caused by the falling of beams BB, bent the former, and for some reason the beam A broke (sideways) first, which relieved the strain on C. Also, when the pier fell, pieces of brick were thrown across a passage, about 3 ft. wide, and through a window of the adjoining building. The pier was also built during freezing weather.

Considering all of these points, and also the way in which the beams BB rested on the pier, the engineers employed on behalf of

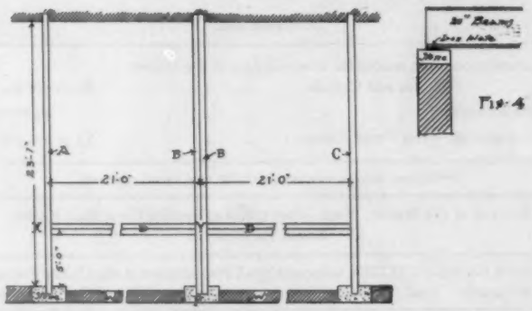


Fig. 1

Fig. 4

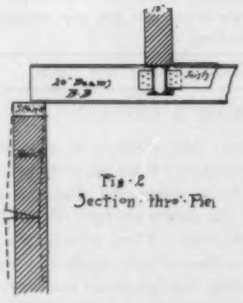


Fig. 2
Section thro' Pier

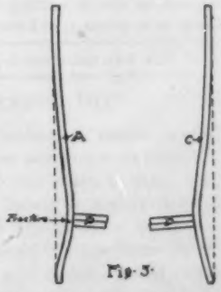


Fig. 3

the company that furnished the steel came to the unanimous conclusion that the collapse was caused by the buckling of the pier P, something in the manner indicated by the dotted lines in Fig. 2.

The above concisely states the facts in the case. The lesson to be drawn is the necessity for closely computing the sizes of all structural work, especially where loads are concentrated, and the importance of *loading piers symmetrically*.

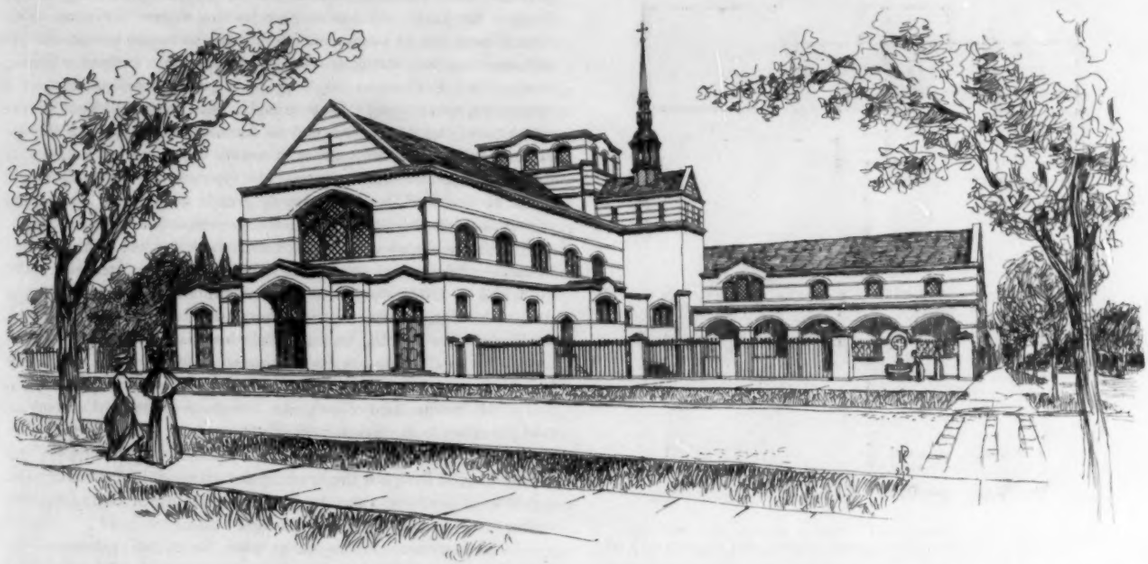
The materials of which the pier was built were of good quality, for the locality, and the curtain walls also added strength to the pier.

If the beams had rested on the pier, as shown in Fig. 4, the pier would probably have supported the load, although when the building was completed and occupied, and perhaps had a foot of snow over the roof, probably no engineer would have pronounced it safe.

A Village Church, Cost Fifty Thousand Dollars.

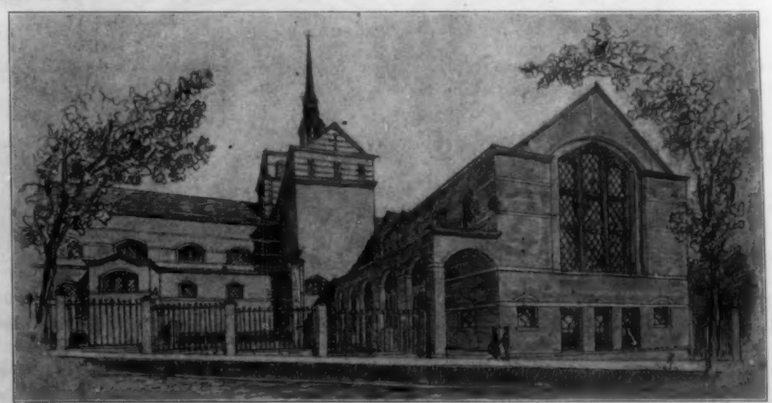
BY ALLEN B. POND.

A CHURCH building committee has sometimes seemed to me a most impossible thing, a veritable hydra, with a profusion, or rather confusion, of heads. And now comes THE BRICKBUILDER,



bearing oil and wine, and saying: "Behold a village of 25,000 inhabitants, needing a church. Here is the lot. The conditions are thus and so. There are ready for your use $50,000. Have your own way. Do as beseemeth you best."

Before we begin the definite study of our plan problem and the simultaneous synthetic prevision of the forms with which our plan is to be bodied forth, let us, for a moment, turn aside to consider the church as an institution and to ask ourselves what its function is in modern life, what part it ought to play in the modern community. From the broad-viewed windows of our attic workshop we look down observantly on the tendencies and drift of the thought and life below us. We note that the pulpit as a platform for the affirmation of *ex-cathedra* doctrines or for the assertion of creeds curiously remote from the pathways of modern thought is losing ground. We see one group of men seeking to stem the tide by reversion to liturgy and ritualism, another group seeking to convert the church from a platform for doctrinaire discussion into an organization for multiform social and communal activity,—a so-called institutional church; yet other groups reaffirming with grieved and combative spirit the supremacy and efficacy of their several opinions and beliefs; while still other groups timidly or boldly assert that the day of the church is done, that its place was in the twilight of ignorance, not in the clear light of the sun of science.

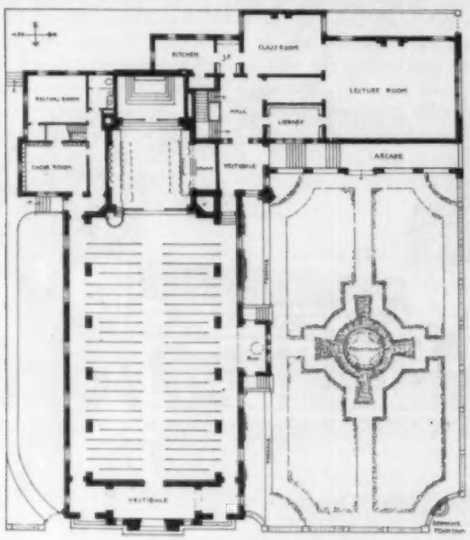


It is plain that many functions that the church once wholly or in large part filled have passed or are passing from its grasp. The control of temporal government, the rendering of judgment and execution of justice between men, the monopoly of organized charity, exclusive jurisdiction over marriage and divorce, education of all grades,—these functions, in many places and over long periods, either from the necessity of the case devolved on the church, or were claimed by the church as of right. Once, learning, the custody of books, the dissemination of literature, almost the entire intellectual life of the community, inhered in and centered about the church.

Is the church then an anachronism? Is the church building which we are to erect destined to satisfy only the passing desire of a few, and not a deep and permanent need of the community? What functions are left for the church in our busy, industrial, scientific, modern life? One, certainly, and that of deepest moment to a humanity whose chief distinction is that it is differentiating itself from the beast. Among all the beneficent agencies of modern life there is none other that directly functions the life of the spirit. We have scratched the shell of science, only to apprehend more clearly the magnitude of that main miracle, an ordered cosmos, evolving, progressive; and, conscious of reason, we bow in reverence and humility to the all-comprehending mind. Struggling painfully with conflicting desires and with weakness of will, we yet feel the stirring of "a power within us, not ourselves, that works for righteousness"; and, conscious of love, we are fain to believe that the beneficent power springs from a mighty and a loving heart. In our utter

loneliness in the great crises of the soul, our spirits strain for communion with a something that knows and understands; and, conscious of spirit, we reach upward with desperate faith to an understanding Being whose essence is spirit, and whose spirit is akin to ours.

We have spasms of cynicism; we are nagged by doubts; but ineradicable in humanity, forever recur the reverence, the humility,



the love, the faith; and from these grow religion and the worship of the spirit that we name God. The optimism and the courage that are indispensable to wholesome living and to strong creative work are dependent on this reverence, this humility, this love, this faith; when they are lost to an individual in any age his life becomes a routine of bitter duty, or descends to the animal plane; and the age to which they are lacking falls barren, and the life of the spirit shrivels away.

The act of worship cannot of itself create reverence and faith, but the psychological reaction needs no argument; the systematic expression of a feeling gives to it life and growth. Here then is a vital and permanent function for the church: to foster the life of the spirit; to stimulate reverence, humility, love, hope, faith; to give definite expression to these feelings by the act of worship; to inculcate that attitude of mind toward life that inheres in and springs from these feelings, and thus intimately to influence the conduct of life. The pulpit as a doctrinaire platform may pass away; creeds may come and go; but the church as the "house of worship" must remain, its liturgies and its rituals, purified and refined, voicing for men their deepest feelings, their loftiest aspirations, their noblest ideals.

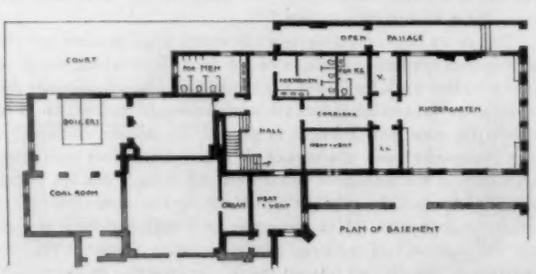
Our diversion has led us back to our building and has served to indicate to us broadly certain ends we are to seek and certain limits we are to heed. Our task is to design a building which shall be a fit "house of worship," a place beautiful as befits the life of the spirit, a place instilling by its aspect calmness of mind, a place in harmony with feelings of reverence and of faith, and calculated by subtile suggestion to stimulate these emotions.

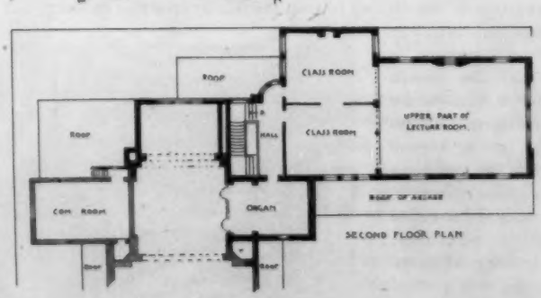
To this end we are to avoid forms and combinations, perhaps not inappropriate in themselves, but by common use connected with and directly suggestive of other and irrelevant moods and activities. Only the most urgent reasons will induce us to depart from this principle in any instance, and then the departure, instead of being flaringly emphasized, will be carefully subordinated to the general effect. Whatever we may see fit to use of new forms and arrangements, we shall best serve our end if we combine them with and subordinate them to forms and types, good in themselves and suited to our particular need, which by long usage and deep-seated power of association are calculated to suggest the mood for worship. To startle and to amaze do not belong to the church; the fantastic and the bizarre, the puerile and the ostentatious have no place here.

The activities of our community are not those of war, and our building will not be boldly defiant, half fortress and half church. We are not the center of a great metropolitan district, and the type of the great, high-arched cathedral is not for us. The wide, well-shaded streets, the little park across the way, and the snug library beyond the park, combine to give us the desired keynote. Our church must not jar on this environment, must not be bumptious and self-assertive, but, fitting quietly into place, must evidently belong where it is. Even so, we might properly give it the distinction of a lofty spire, symbolizing thus the aspirations and the ideals of the worshipers; but, low and broad in its masses, with only a slender lantern on the close-clipt tower, it seems to us, in this instance, to express our conception better and to typify in its restfulness that peace of God that its worshipers so greatly need in the hurried and strenuous and complicated life of the modern community.

We have found a sufficient *raison d'etre* for the church in its fostering of the life of the spirit, in its nourishing of reverence and faith, and in its persuasion to the worship of God, the Father of spirits; but the church has still other work to do in our complex modern world. Not the least striking phenomenon in the growth of the early Christian church was its breaking down, within the sphere of its own organization, of distinctions of class and caste, its affirmation of the brotherhood of man as a corollary to the fatherhood of God, its effort to express in daily life its sense of social unity. The lapse of nineteen centuries has witnessed radical changes in the forms of social life; but the need of the affirmation of brotherhood is greater if possible in the American community of to-day than it was in the Roman world of the Cæsars.

In theory many forces are at work for social unification: facility of travel, multiplicity of newspapers, common-school education, a democratic organization of political life. In actuality there is to-day a seeming growing antagonism of interests and classes. From





our high attic windows we note the ranging of employed against employer, of laborer against capitalist, of corporation against individual, of rich against poor, of white against black; we hear in each growing community a jargon of tongues like unto Babel, emblematic of a jargon of points of view far more to be dreaded. We seem to dis-

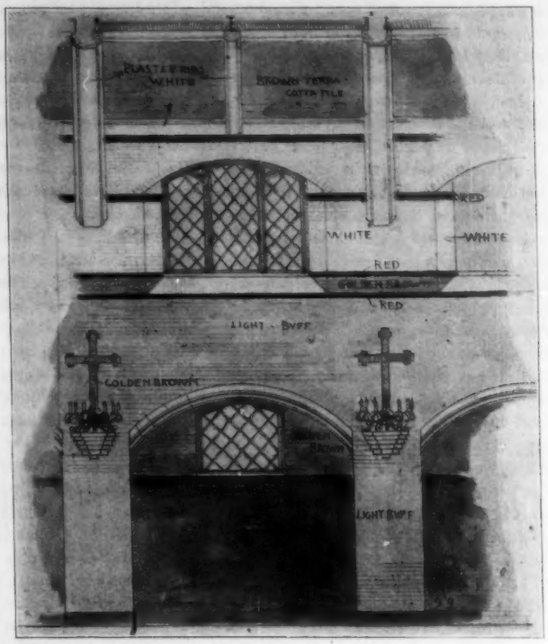
cover that we are, in our industrial and social life, heterogeneous, disparate, antagonistic; that class irritability is displacing the consciousness of solidarity; that a renewed and vivifying sense of the brotherhood of man is imperative, in order to pave the way for social progress, if not to avert disaster.

The church, if true to itself, can know neither caste nor class; its message is the gospel of sonship, of brotherhood, of love; it stands for forbearance, for self-control, for justice, for solidarity. Among all the beneficent agencies of modern life there is none other that can so singly, so unswervingly, so effectively function solidarity, the oneness of society. In the church of the future we shall hear little of the reconciliation of God to man; in the church of the future, unless it fail wholly of its function and be cast aside like a worn-out garment, there shall go on unceasingly and triumphantly the reconciliation of men with men. It is this phase of the character of the church that is behind the impulse toward the "institutional church," a church that shall not be remote from life, foreign to our thought, and alien to our necessary activities. It is for the more adequate expression of this phase of church life that we need to supplement the church as the house of God with the church as the house of Man; and hence, by the side of, or, better still, united to our house of worship, we will plan a parish house, with provision for social activities, for the expression of and upbuilding of social unity. The type of our parish house will be ecclesiastical, because it is still the church, though in its social aspect; but there will be in it also a hint of the home feeling, the arcaded porch reminiscent of cloistered calm, and the fireplace potent with cheeriness.

Our church building shall stand well to the north of the lot, its chief entrance to the west by an ample vestibule, kept low to admit the western light through the window at the nave end. A similar window to the east will abundantly light the altar space; and from the high windows above the choir will fall a diffused and softened light. The choir room, the pastor's study, and a room set aside for the meetings and records of the vestry and the parish board committees, we will provide north of the choir, with access from the aisle

and by a separate doorway from the narrow close at the north of the church.

The parish house shall lie well toward the east of the lot, with sunlight from south and east and west. Here shall be a lecture room and a drawing room and various study and club rooms, having their entrance up the cloistered walk at the garden side by a vestibule un-



der the low, square tower. The rooms shall be reached severally, and yet be *en suite*. Toilet and cloak rooms easy of access shall be placed down the stairs, where also for the little tots shall be a kindergarten flooded with sunlight and having its separate access from the east, and toilet and wardrobes of its own. In the parish house shall be a kitchen and a serving room, and a miniature stack room for a parish library. But we shall place bookcases, *sans* doors and open to all, in the lecture room; and if no equipment fund is forthcoming, we shall write a specification for some rattling good books, and shall include them in our contracts.

We will bind our two buildings together by placing the tower in the angle at the head of the cloistered walk and of the southern aisle; and the tower vestibule will serve to connect our house of God with our house of Man, emphasizing thus the necessity of an intimate connection between the life of the spirit and the activities of men. We will clothe the exterior walls with a purplish-gray brick trimmed with white terra-cotta; the roofs shall be covered with a moss-green shingle tile; and the lantern, clad in terra-cotta, shall echo the purple-gray of the walls. In the cloister, as in both vestibules, shall be a patterned pavement of dull red bricks; cool gray bricks will fit better for the walks of our garden. For in the angle between the buildings we shall plan a formal garden, open on the highway to west and south; and, as the ground falls away to the east some five feet in the length of our lot, we will sink the garden so that it shall be entered from the lower cloister level, and the passer-by shall look down through the wrought-iron guard onto its walks and turf and into its sparkling fountain. A terrace shall rise from the garden to the church, and from the south aisle a little porch, containing the font, shall give upon the terrace by doors to east and west.

In the church interior we will seek to unite the pervasive charm of rich, soft colorings with a marked breadth of architectural treat-

ment,—a chaste severity of line, a fitting dignity of form. We shall avoid plaster for the most part, and shall achieve permanent first-hand decorative effects by the use of brick and terra-cotta. The walls of both vestibules and the aisle walls, forming a background for the nave, shall be faced with brick, red below and golden brown above. The piers carrying the nave walls, and the nave walls up to the clearstory window sills, shall be in buff brick, light almost to a cream, and then, above belts of red and golden brown, in white brick to the cornice line. The chancel walls shall be enriched by dull-finish glazed bricks in warm, strong tones.

The exigencies of our climate, its extremes of heat and cold, forbid us to let the real roof form the ceiling; and, supported from the roof trusses by light tee iron, we will suspend a ceiling of book tiles, yellowish brown in effect, but not selected for uniformity of color, and varying, as they come from the kiln, from warm buffs through reddish browns to a tile here and there as deep as umber. The lower member of the trusses will project below the tile, and we will finish these with plaster colored an ivory white. Our woodwork will be black oak, partaking in its general design of the prevailing simplicity, but blossoming into greater elaboration at the pulpit, the organ, and the chancel. Miscellaneous, hit-or-miss, wishy-washy, or hard-visaged, memorial windows, donated in a misguided spirit of mingled pride or devotion, shall be barred out. No glass will be permitted to be set, except such as has the true, deep, rich color that will give to the whole interior that soft, indescribable glow that we already see in our mind's eye. All memorial windows must pass our approval as to design and execution. For the present we are likely to use only a simple, unobtrusive, geometrical subdivision, and to content ourselves with color unaided by design.

In the parish-house interior we shall not be able to afford facings of brick, but we shall take care that our plastering has a finish that will give a texture effect to the colorings we shall choose. Here, while avoiding any freakishness or triviality of treatment, we shall relax the severity of style, and shall seek to impart a certain homelikeness well suited to the expression of the building's purpose.

In the end we shall hope to have made our church typify its purposes so clearly and yet withal so alluringly that the passer-by, pausing for a cup of water at the fountain at the crossing of the ways, and looking down into the garden, shall be tempted to turn aside into the cloistered walk, and to enter the parish house and church, and that entering he shall linger for a moment, and lingering shall become conscious, even though dimly, of a something that puts the spirit in touch anew with God and Man.

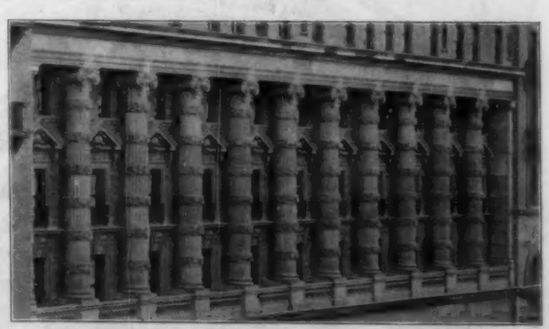
THE amount of live load as distinguished from weight of materials in construction, which should be assumed in calculating the strength of the floors and columns of the modern commercial building, is a matter which has been in dispute among the best authorities, and erring as they do generally on the side of safety, nearly all of our building laws have required an excessive amount of material, providing for loads which in practise never occur. In the new building law which has been proposed for New York City, an attempt has been made to recognize the absence of any necessity for excessive provision of this kind. In New York and Boston the laws as they at present exist call for provision for live loads of 100 lbs. per foot in an office building, the whole of this load over every square foot of floor being assumed as transferred to the girders, and thence to the columns, and so down to the foundations and the ground. In Chicago the practise has been to scale down these loads, assuming that only a certain portion of the floor is loaded as a whole at any one time, and that if, for instance, 100 lbs. is assumed for the live load of the floor a load of only 80 lbs. need be assumed in calculating the girders, still less in calculating the columns immediately supporting the girders, and considerably less for the bottom columns, the foundations, etc. Actual investigation has shown that the loads on the floors of a modern commercial building seldom exceed 15 lbs. a foot. While this might be a dangerous minimum for the law to recognize, the change in the New York laws is certainly a move in the right direction.

Design and Construction of Terra-Cotta Columns.

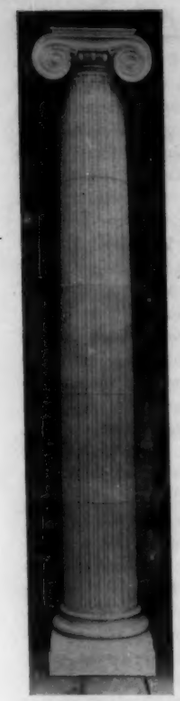
IN an article of recent date, appearing in *The Architectural Review*, Mr. Russell Sturgis offers a number of timely suggestions on "How to Treat the Classical Orders." Without intending to dispute, much less deny, the abstract beauty of Grecian forms in their original purity, he accepts the inexorable conditions of life in our own time, and would meet them, in each case, by a free adjustment befitting the environment. To quote his opening sentence: "It seems clear that no order which any Greek devised, and none which was used in Roman imperial buildings, will, without alteration, serve the turn of the twentieth century." In this, he has no thought of turning away from the perfected types of an age when architecture, as an art, had reached its zenith; but he would insist on a less literal reproduction of accepted examples. Even the Roman Ionic — itself a bold adaptation, due to the arch having in a measure superseded the lintel — Mr. Sturgis holds open to needful modification. Referring to the Theater of Marcellus, he is especially emphatic in that contention. "To take the proportions and minute details of that order and apply them to the thin-walled modern building, or to use them at all without alteration for the parts of a free colonnade, is to do a thing devoid of intelligent propriety."

HOUSE OF MELEAGER, POMPEII.

This is, no doubt, a perfectly justifiable assertion, one that would not be disputed by cultivated architects; yet worse things than that are of common occurrence, and usually pass muster without protest. We could mention a building, for which eminent members of the profession are responsible, and in it stilted semicircular arches spring from Grecian Ionic capitals — a combination that would seem equally open to criticism, yet the effect is not by any means disagreeable. A replica of the Erechtheum capital might be said to look out of place against a background of plate glass in a modern store front; but there it would, at least, support a trabeation of the kind for which it was originally intended. As a matter of fact, that capital is frequently employed without material change, and sometimes on shafts with which considerable liberties have been taken. An illustration of such use may be seen on a somewhat extensive scale in the Posner Building, Baltimore, now in course of erection.

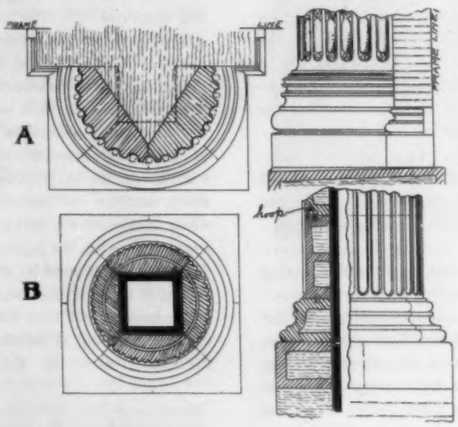


COLONNADE, 34TH STREET ELEVATION, ASTORIA HOTEL, NEW YORK CITY.



COLUMN USED AS WINDOW MULLION, POSNER BUILDING, BALTIMORE, MD.

On the first story of that building there are, in all, ten of these columns; and, as will be seen on plan, a cast-iron core carries the superincumbent weight, the same being cased with thin segments of cream-white terra-cotta. The flutes, in this case, are filled with a convex billet to the full height of column, stopped at necking by an inverted honeysuckle, which is also something of an innovation. This device, by tending to subdue the needless severity of a fluted shaft, renders slight imperfections less noticeable than they would otherwise be at close range. It also helps to strengthen the fillet and offers less chance for such wilful or accidental defacement as may be expected when delicate members are within reach of the passing throng on a city's sidewalks. It will be noticed that the size of the square core, in a necessarily slender cylinder, reduces the thickness of casing to a minimum of 1½ ins. at the neck, and so makes it impossible to break joint with successive segments. The vertical joints had, therefore, to be continued without break, which made it imperative to devise some means of holding the segmentssecurely in position. This is managed very effectually by inserting a hoop of galvanized iron at every joint, half of which goes into a groove in the top and bottom bed, respectively, of each course. This work is set tight, the exposed joints averaging about one eighth of an inch, but the rebate in the ends and the interstices around the hoops leave sufficient room for a bedding of cement, which, when set, holds the components of the outer casing immovable. In his reference to the colonnade that embraces the third, fourth, and fifth stories, on the 34th Street elevation of the Astoria, Mr. Sturgis falls into a curious mistake; which, paradoxical as it may appear, goes to show how thoroughly he grasps the main facts of his subject. In assuming that "That colonnade, too, comes close home to our requirements, for it is of terra-cotta and in hollow cylinders, set one upon another, and surrounding an iron column as beads are strung upon a thread," he has described what *ought* to have been more accurately than what is. Certainly an iron core is there, for the ten stories above must needs be supported; but the hollow cylinders are, for some reason that is still quite inexplicable, cut out of stone, instead of having been molded in clay to the required shape, like all other work above the third story on the same building.

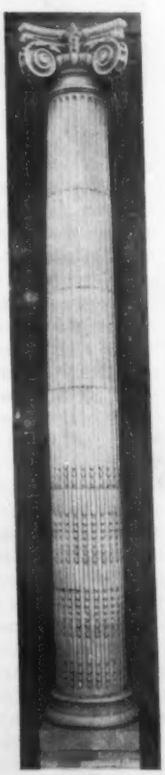


A. COLUMNS, HIGH SCHOOL, TROY, N. Y.
B. COLUMNS, POSNER BUILDING, BALTIMORE, MD.

To fit these stones around the flanges of a riveted column, to flute the drums and carve all the alternating bands, as well as the capitals, was a laborious undertaking, and one that must have entailed great expense. They had, moreover, to be made in segments, for the riveted connections precluded the possibility of their being put on in any other way. In view of the fact that there are ten of these columns, the same design could have been carried out with greater facility and in a more enduring material at perhaps one third their actual cost in stone. Of all the terra-cotta used on that immense building there is nothing better adapted to the peculiarities of burned clay, hardly anything on which good modeling could have been displayed to better advantage, and no single item that would afford so wide a margin for the exercise of legitimate economy in cost of production. With conditions so exceptionally favorable, we cannot wonder that the choice of so fitting a medium should have been set down as a matter of course. We have searched for but failed to discover any obstacle likely to be encountered in the execution of this colonnade, beyond what has obviously been overcome in connection with the three tiers of terra-cotta windows in the screen wall immediately behind it. Far more exacting subjects had to be dealt with in the dormers and pavilions around the fifteenth story, while the engaged columns at the tenth and eleventh stories called for much greater nicety, because of the absence of projecting bands, which serve to conceal possible imperfections at the joints.

It is, of course, possible that the architect desired and expected to obtain a degree of uniformity in color beyond what he supposed procurable in terra-cotta. If so, he must have been grievously disappointed; for the result not only falls short of any such expectation, but goes far to reverse what was once conceded to be the natural order of things. It is in the terra-cotta that we find a uniformity, which in the adjacent stonework is conspicuous by its absence. Those who have seen the building do not need to have this remarkable contrast pointed out to them; those who have been denied that privilege can form some idea of the extreme variation in the stone by turning to our illustration, which is made from a recent photograph.

A column, not too large to be made in complete drums, is used as a window mullion in the upper stories of the Posner Building. The architect, Mr. Charles E. Cassell, at the suggestion of present writer, agreed to a style of treatment similar to that already described, so far as the absence of fluting is concerned. The effect of reed and fillet is much better than might be supposed by those who have not tried the experiment. This deviation from classical precedent is admitted, but it can be urged in extenuation that greater, and, we think, less justifiable departures could be charged against the Greco-Romans, who, by the way, were not quite so punctilious in their adaptations as some of our modern copyists. Among the columns recovered from the ruins of Pompeii and Herculaneum, to which Mr. Sturgis has directed attention, some were left entirely plain. Another variety had the lower third plain and the upper two thirds fluted; while a further compromise was effected by reeding the lower and fluting the upper portion. On the shafts of one peristyle the fluting was merely indicated in outline; while the capitals appear to have been improvised rather



COLUMN USED AT ENTRANCES, SCHOOL NO. 10, TROY, N. Y.

Brick and Marble in the Middle Ages.

BY G. EDMUND STREET.

CHAPTER XI.

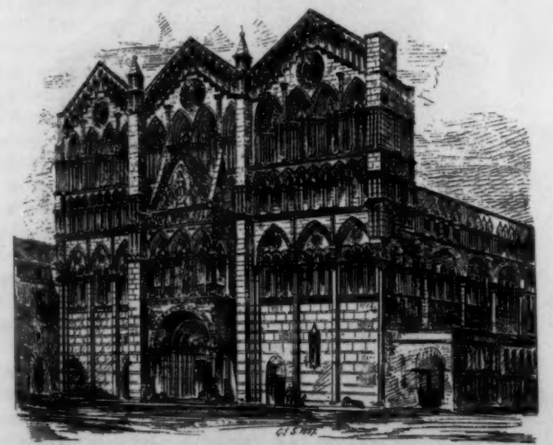
"In the elder days of art,
Builders wrought with greatest care
Each minute and unseen part,
For the gods are everywhere."
— *Longfellow.*

Drive from Padua to Ferrara — Monselice — Rovigo — Ferrara: Cathedral — Castle — Gallery — Road to Bologna — Altedo — Bologna: Cathedral — San Petronio — San Domenico — San Giacomo — Sta. Maria Maggiore — San Francesco — San Stefano — Leaning Towers — Casa dei Mercanti — Domestic Remains — Academy — Modena: Cathedral — Parma: Cathedral — Correggio — The Baptistery — Piacenza: The Palazzo Publico — Cathedral — San Francesco — Sant' Antonino — San Giovanni in Canale — Asti: Cathedral — San Secondo — Campanili.

[The illustrations A, B, C, D, and E are not taken from Mr. Street's work, but are added as additional illustrations of the Italian brickwork.— EDS.]

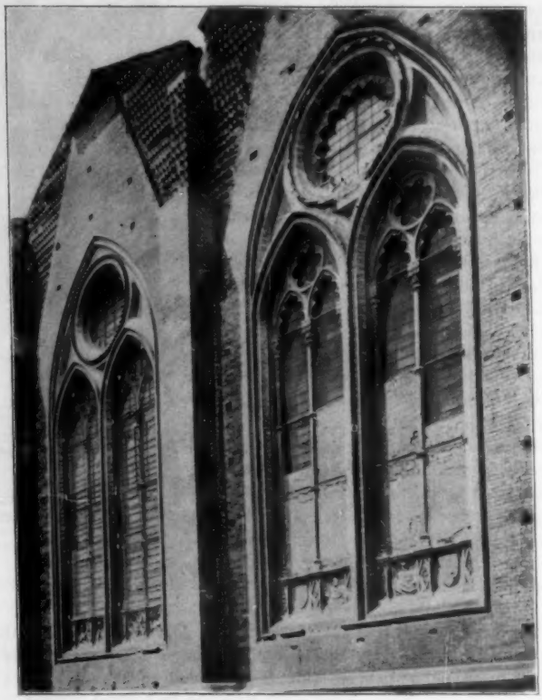
ANY one who has followed the route from Venice to Milan described in the last chapter will do well, instead of following it on a subsequent visit, to make a *détour* from Padua to Ferrara and Bologna and thence by Parma, Modena, and Piacenza to Milan. I shall give some notes of such a journey in this chapter, the towns visited on the road completing the subject which I have set before me in this volume, and leaving no important city north of the Apennines, save Ravenna, undescribed. This exception is serious; but the omission will be remedied naturally when, as I hope I soon shall, I ask my readers to go with me to the towns on the east coast of Italy.

The journey from Padua to Bologna is now, and I suppose always was, extremely uninteresting. The only objects on the road which possess much attraction for the artist are the towns I have mentioned, and these certainly much more repay a visit than do those on the parallel line of road which we have just travelled. Scenery there is none to speak of, and fortunately a railway makes the journey a quick one now; but when I first travelled it I retained no recollection at the end of the route save of long straight and



DUOMO, FERRARA.

dusty roads lined on either side with tall poplars, and wearisome to the last degree. At Monselice we found a picturesque town domineered over by the ruins of a large castle, whose walls climb the steep sides of the hill on which it stands. Here I saw a good and little altered Romanesque church, with pilasters in place of buttresses, and walls crowned with the usual eaves-arcade. At Rovigo,



(A) CHURCH OF SAN PETRONIO, BOLOGNA.

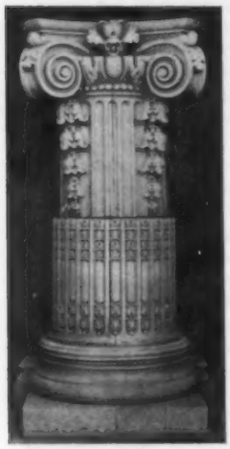
further on, there is one of the tall brick towers so common here, with its Ghibelline battlement perfect. Just before reaching Ferrara we crossed the Po — here a large, unbridged, and dreary-looking river, flowing rapidly between high artificial banks to the sea. Its bed is, I suppose, now quite above the level of the plain, and year by year the question becomes more urgent and yet more difficult of answer, what is to be done with it? Certainly there are rivers and rivers; and this great stream left none but painful and disagreeable impressions on my mind. At length, after ten hours and a half of the slowest of drivers and worst of vehicles, we reached Ferrara — a *trajet* now performed by railway in about an hour and a half, with advantage to every one's time and temper, and no counterbalancing loss.

The entrance to the city through a dirty suburb of tumble-down houses was not prepossessing. I knew nothing of what I had to see, and my delight was therefore all the greater when we drove into the piazza in front of the Duomo, and I found myself gazing at a building which at first sight looked as though it had been brought straight from the North of Europe, and planted here in the thirteenth century as a warning against Italian fashions! Further examination proved that I was not far wrong in my first estimate of the west front; but it revealed also, I am sorry to say, that this and part of the south side were the only parts of the old cathedral which had been spared, when in the seventeenth century the whole of the church was gutted and converted into about as bad a Renaissance building as one could wish not to see.

The west front is a great screen, and does not and never did follow the line of the roofs. It has three gables of about equal height covered with arcading, which increases in depth and richness of moulding and shadow to the top, where there are very fine open arched galleries, stepped up to suit the raking lines of the gables. I

than copied from earlier examples, which must, at that time, have abounded on every hand.

We have not resurrected these remnants of Roman architecture as models of refined detail worthy of unqualified acceptance. Still less do we refer to them in order to excuse the crudities too common in current work, perpetrated by men who think they have been born to create something that did not previously exist. But they serve to show that every age has had its own problems to solve, and that the people who had vanquished their comparatively effete predecessors set about the task that lay before them with characteristic vigor and fertility of invention. We are not expected to do exactly as the Romans did, though there are many points of resemblance between their work and that of to-day. Their spirit of self-reliance and resource should be a valuable stimulus to those who are, perforce, the pioneers in a new era of architectural development. Just as the Roman arch gave rise to new systems of building more than two thousand years ago, so the steel skeleton has revolutionized modern methods, if not beyond recognition, certainly beyond possible expectation. In some respects they are rendered far more complex, yet in others they have been greatly simplified, and in nothing is this more noticeable than the increased facilities afforded for the use of terra-cotta columns.



COLUMN USED ON HIGH SCHOOL, TROY, N. Y.

The skeleton of a modern building, made up mainly of vertical and horizontal lines, resolves itself into successive tiers of posts and lintels. While this anatomy is self-supporting, it requires a protective casing on which varying degrees of embellishment are permissible, and the voids must be enclosed to make it habitable. This casing takes the form of brick piers built around the main structural supports, with sill courses below, entablatures above, and intermediate columns, pilasters, etc., between the windows. The latter are often decorative rather than supporting members, and, therefore, have little weight resting upon them. Up to a diameter of say 16 ins., columns of this kind can be made in single drums, capable of sustaining an enormous weight without any core whatever. If a stanchion should be introduced in those of smaller diameter to prevent buckling, or as a necessary part of the steel frame, these drums can be left hollow and provision made for threading them on from above. Or, where this plan is found impracticable by reason of riveted attachments, they can be molded in two pieces and the joints broken in setting successive courses. In larger diameters, whether the core be metal or built solid in brick and cement, the casing need not average more than 6 ins. in thickness, as it would be jointed up in three or more segments. In the latter case, vertical joints should be broken every course, the brick filling bonded into the chambers, all interstices being grouted with cement.

A good specimen of the free-standing Roman-Ionic column will be found in an adjoining illustration. It is 16 ins. in diameter at the base, and 13¼ ins. at the neck, and is made in complete drums, each about 20 ins. in length. Without core or filling of any sort, it might be used with safety under a load of 20 tons, though it is not called upon to support more than one tenth of that weight. Two of them carry an entablature of slight projection at each entrance of School No. 10, recently erected in Troy, N. Y. The base and capital, with the top and bottom sections of an engaged column, is likewise shown from a photograph, which will be better understood by referring to the accompanying plan. This column is not bonded into the wall; but — which we consider much better — the wall is bonded into the column in such way as to render steel or cast-iron reinforcement altogether unnecessary. Four of these are used on the principal elevation of a new high school in the last-named city, for which Messrs. M. F. Cummings & Son are the architects. Rather larger columns of the same general character in design and principle of construction occupy a similar situation on a building designed by Mr. J. E. Sperry, of Baltimore. In another building with which we are acquainted, a cast-iron upright stands part in the wall and part in column, to which the floor and roof beams are, we presume, connected; otherwise, it too might have been omitted without risk of crushing the core or its casing.

With the exception of granite monoliths, which cannot be surpassed for work on a first story, there is hardly a situation to be met with in current practise where terra-cotta columns may not be used in preference to stone. To quote Mr. Sturgis on this point: "We can still, when we have an open portico, build it of iron and sheathe every part of it with baked clay in the most approved fashion of fire-proofing; we can obey the law, meet the requirements of the higher common sense, and design in a pure Greco-Roman taste — all at once. We can also design in a pure modern taste, taking our traditional suggestion from the finest things of the past, working it out on lines of our own, going slowly, because our successors will do better than we in the light of our own experience and our own partial successes. . . . It was said above that we could make our constructional columns decorative, by means of terra-cotta, by using that material to sheathe the iron uprights essential to the structure. It might also have been said that we can perfectly well make terra-cotta columns do their work without the iron within; for in many of the smaller colonnades the structural purpose is only apparent, or, at most, only secondary, and a very slender upright of metal, such a stud as serves for stiffening partitions in our dwelling houses, will serve the turn. Whether the colonnade is to decorate the veranda, while it carries the veranda roof, or to adorn the interior of a ball-room or theater, the proper relationship of design to construction is not at all abandoned by the concealment of the actual metal upright, bolted at top and bottom, by a jacket of defensible material. That is the essence of all our future building; the concealed slender skeleton, the clothing of brick and cement, as if of bodily muscle, and the sheathing of the whole in its terra-cotta skin." Having read

CENTRAL FEATURE, BREWERS' EXCHANGE, BALTIMORE, MD.

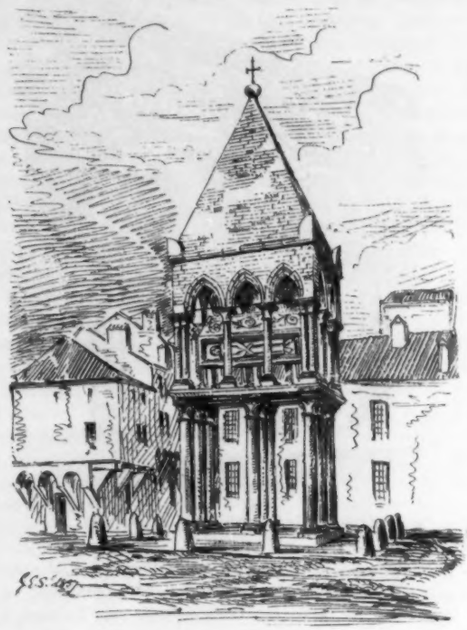
this comprehensive summing up, one can but regret that Mr. Sturgis should have retired, as we think, too soon from the active practise of his profession.

BRICK WINDOW, PALAZZO PUBLICO, BOLOGNA.

The streets are not of the best. They are very narrow, and often arcaded with pointed arches supported on circular columns, but contain few houses of any interest, whilst the churches have been a good deal altered and damaged in modern times.

The cathedral is a recent building of no beauty. Two lions which once supported the columns of a Lombard doorway now carry the holy-water stoups; and in a passage near the sacristy is a carved, painted, and gilded rood of the twelfth century — a piece of furniture which is rarely found remaining in Italian churches. The grandest church in Bologna is undoubtedly San Petronio, which is well placed on one side of the Piazza Maggiore. It was not commenced until 1390, so that we must not be surprised to find the faults in detail which mark the period. But the general scheme of the church is so magnificent that these faults do not strike the eye at all offensively. As it stands even now, with only its nave and aisles finished, it gives a vast idea of size and space, though this is hardly appreciated at first, owing to the enormous dimensions, the fewness of the parts, and the extreme simplicity of all the details. The west front is of immense size and width, but its only finished parts are the plinth and doorways, the whole of the rest being left in rough brick. The detail of this finished part is of poor character, and later than the fabric. It is rather richly carved with figures, which are sometimes much praised, but which seemed to me (with the exception of a Pietà over the south-west doorway) to be of poor style and character. Going round to the side of the building, the design is of earlier date and much more interesting. The aisle-windows are noble designs of four-lights in each bay, separated by buttresses and surmounted by steep-pitched gables. The detail is an extremely good combination of brick and stone, whilst a magnificent plinth of stone and marble gives great force to the work. The transept was never built; but at the point where it was intended to be connected with the aisle, there is a curious conceit — a window at a projecting corner with half its arch and tracery facing south, and the other half facing west. It is, so far as I remember, a unique example in a church, but is just a little like the angle-windows in some of the Venetian palaces, though these never indulge in such an absurdity as is the construction of two halves of pointed arches over such an opening.

The interior is very magnificent. The columns, arches, and walls generally are of brick, now coloured and whitewashed (but originally intended to be seen, as is evident from parts of the incomplete work where the internal brickwork is still exposed and is executed with the greatest care), the capitals and bases being all of stone. The columns of the nave are bold clusters; they are about sixty feet from centre to centre, rather short in proportion to the height of their capitals, which are carved with stiff foliage. Above these is a large pier running up to carry the groining, and there are pointed arches opening to the aisles of very lofty



MONUMENT, BOLOGNA.

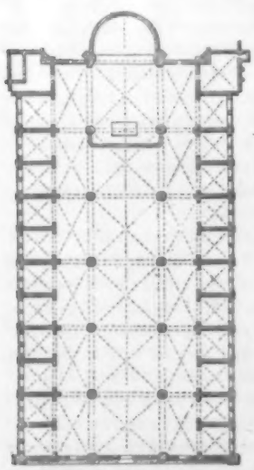
pitch, but which, owing to their great size, certainly look very attenuated. Two chapels open into each bay of the aisles: these are lighted by the large four-light windows already mentioned, whilst both nave and aisles have no windows except cusped circular ones of no great size, placed as near as possible to the groining, which is very simple throughout the church. There is scarcely a horizontal string-course or a label to be seen, and the mouldings are few and simple; yet, nevertheless, the effect is grand. Such a church may well trouble the mind of the English student who thinks that no building is complete which has not its arcade, its triforium, and its clerestory. One of our puny churches would stand — nave, aisles, chancel, tower, and spire and all — within one of the bays of the nave and aisles here; and there is a grand sense of restraint and simplicity about this work which impresses me more each time I see it. At the same time the interest is of this grand kind — there is a sense of the immense and infinite, but no condescension to the love of detail and delight in dainty variety which undoubtedly strikes us in most good Gothic works, and makes them so enjoyable.

SAN PETRONIO, BOLOGNA.

The church which inspired the design of this was, no doubt, the cathedral at Florence. But of the two the design of San Petronio seems to me to be the more beautiful. The addition of chapels beyond the aisles and the tra-

know no Italian work which imitates so closely as this does the extreme richness which some of the Norman and English churches of the same period exhibit. The arches of the arcades are carried upon clusters of columns which are set with extraordinary profusion one behind the other. The centre of the three divisions of the west front is almost wholly filled with a very fine porch of three stages in height, and finished with gables on its front and sides. The lower stage of this porch, as indeed of the whole church, is round-arched, and belongs probably to the church consecrated here in 1135. The knotted shafts which carry the front wall rest on figures sitting on lions. The doorway is deeply recessed, and has figures of saints with scrolls.[1] The tympanum of the arch has a sculpture of S. George and the Dragon, and the lintel below it eight subjects, beginning with the Salutation, and ending with the Baptism, of Our Lord. At the top of this stage is an inscription which contains the date given above. The next stage is later, and has three arches with traceries carried upon chevroned and twisted shafts, with a statue of the Virgin and Child in the centre. This stage forms a sort of balcony. The upper stages are covered with sculpture. In the gable is Our Lord as Judge in a vesica-shaped aureole; around and above Him are saints and angels, and below a group of angels dividing the good from the bad. The subject is continued on to the wall on each side of the porch, where on one side are represented the souls of the just in the lap of God, and on the other the descent of the wicked into the jaws of Hell. The whole scheme is a picturesque and unusually disposed treatment of the Last Judgment. There is, however, not much merit in the sculpture as a work of art, though as an enrichment of the buildings it is most effective. The statue in the centre is said to be by Nicola Pisano. The south front of the cathedral has a long range of arcading carried on engaged columns, each arch inclosing a small arcade of three divisions. Above this, below the eaves, is a very fine arcade of later date all carried on groups of shafts, and treated in the Venetian manner with ogee-arched labels above round arches. This stage is built of red marble; the lower part of the wall, of brick and stone.

SAN PETRONIO, BOLOGNA.



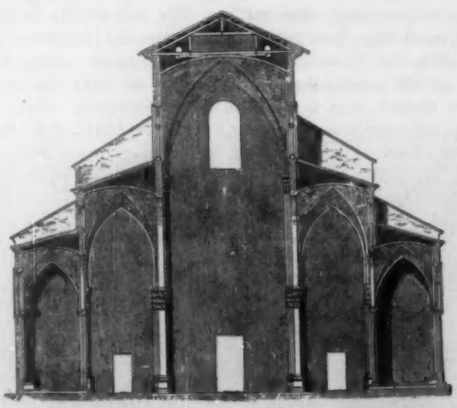
PLAN, SAN PETRONIO, BOLOGNA.

A large font of white marble is the only relic of the original church which is still to be seen inside.

There is not much more to see here. The castle is remarkable as standing surrounded by its moat in the very midst of the city. The old portions of it are much like the castle at Mantua, and present the same boldly battered base, and the same heavy machicoulis and battlements. I saw also two or three old churches here, but of no interest; they were of the latest phase of Gothic — bordering on Renaissance — and very poor in their detail.

The picture-gallery is in a rather magnificent palace of the D'Este family. Garofalo — the best of Ferrarese painters — is represented by a fine Adoration of the Magi, and other works. But the collection generally is not interesting. There are also in the churches a great number of works of other Ferrarese painters, and most travellers go also to see the house of Ariosto and the prison of Tasso. But on the whole the attractions of the city are not great. The streets are grass-grown and deserted, lined with palaces of coarse and bold but uninteresting design, and I was in no way sorry to leave it for Bologna, expecting to find there much more to interest and occupy me.

The drive from one city to the other was very wearisome. The land was rich with vines, mulberry-trees, and rice-fields. The grapes were being gathered, and everywhere along the road we met vast casks borne in grand wagons drawn by white oxen, carrying home the grapes to the wine-press. These wagons have an elaborately carved tree from back to front, and the wheels and casks are also similarly adorned. They are really very handsome, and quite carry one back to those old times when even in utilitarian England the adornment of a carriage was not thought beneath the notice of an artist.



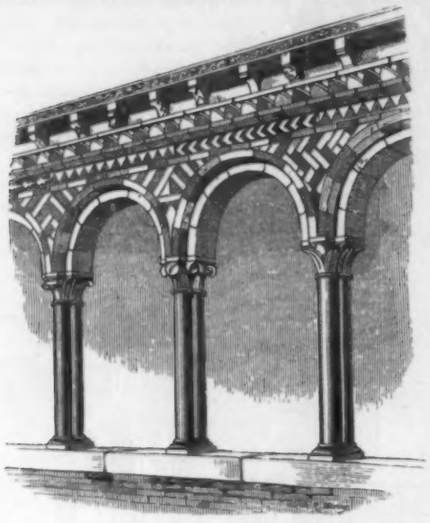
SECTION, SAN PETRONIO, BOLOGNA.

On the road we changed horses at Altedo, where I sketched the good brick campanile of the church.

Bologna is, I fear, only known to many Englishmen at the present day as the one station in Italy at which you may always depend on getting some food, and not less as a station which seems to be on the road to and from every part of the peninsula. There is no excuse, therefore, for not visiting it; and if the general feeling is not one of enthusiasm for what one sees, there is still very much that is worth seeing, and in San Petronio a fragment of a church which, had it been completed on the scale intended, would have been one of the finest and, I suppose, almost the largest in Italy.

[1] Said to have been carved by Nicolò, who is supposed to be the same man who wrought on the west door of San Zenone, Verona. This does not appear to me to be likely; the work at Verona being, I think, earlier than that at Ferrara.

ceries in their windows make the design a little less bald and insipid, and also give a somewhat truer impression of the real scale than one has at Florence. But at the best such work does not create enthu-



CLOISTER, SAN STEFANO, BOLOGNA.

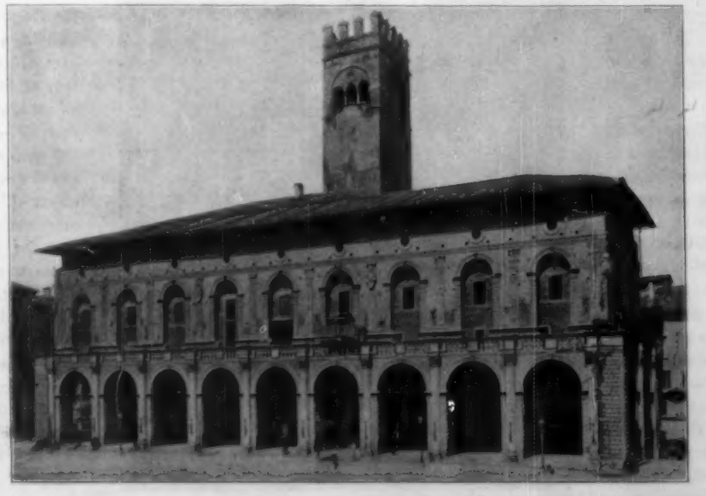
siasm. The principal effort of the architect was to build something very big, and he succeeded; unfortunately he so contrived as very nearly to prevent one from quite realizing how vast his work is, and I hardly know a more serious charge that can be made against an architect than this.[1]

From this church I went to San Domenico, famous for a very elaborate tomb or shrine of the saint by Nicola Pisano. This is not a work that entirely pleases me. It is a high coped tomb-covered with sculpture on the sides, erected behind the altar. The history of its erection by Nicola Pisano in 1265 gives it value as a dated work by a great artist. He seems to have been a good deal assisted by his scholar, Fra Guglielmo Agnelli, whose work is by no means equal to his master's. The tomb alone is the work of these artists, the rest of the work about the altar having been frequently added to and altered in later days, and each sculptor employed having done his best to glorify his own skill and dexterity instead of thinking, as Nicola Pisano evidently did, simply of telling his story in the most straightforward way.

The stories represented in the bas-reliefs had more than common value for a sculptor of original power. In the centre is the Madonna; on one side the resuscitation by S. Dominic of a youth who had been thrown from his horse, and on the other the saint disputing with heretics and burning their books. At the angles are the four Doctors, and at the back two more subjects from the Life of S. Dominic, probably designed but certainly not executed by Nicola Pisano.

The church which contains this tomb has been ruthlessly modernized; but in the open piazza on the north side of it are two monuments of much interest. One of these has a square basement of brick, supporting detached shafts, above which are round arches, the whole being finished with a brick pyramid. Under the canopy thus formed is placed the sarcophagus, marked with a cross at the end, and finished at the top with a steep gabled covering. The detail of this is all of late Romanesque style. The other monument is of later date and much finer design, though keeping to the same general outline. In place of the brick basement of the first this has three rows of three shafts, which support a large slab. On this are arcades of pointed arches, three at the sides and two at the ends, carried on coupled shafts, and within this upper arcade is seen the stone coffin carved at the top, and with a stiff effigy of the deceased carved as if lying on one of the perpendicular sides. This monument is also finished with a brick pyramid. The whole design is certainly striking; it has none of the exquisite skill that marks the best Veronese monuments, but it is a very good example of the considerable success which may be achieved by an architectural design without any help from the sculptor, without the use of any costly materials, and with only moderate dimensions. The upper tier of arches is kept in position by an iron tie, and, in spite of its slender look, still stands after five hundred years' exposure, in perfect condition.

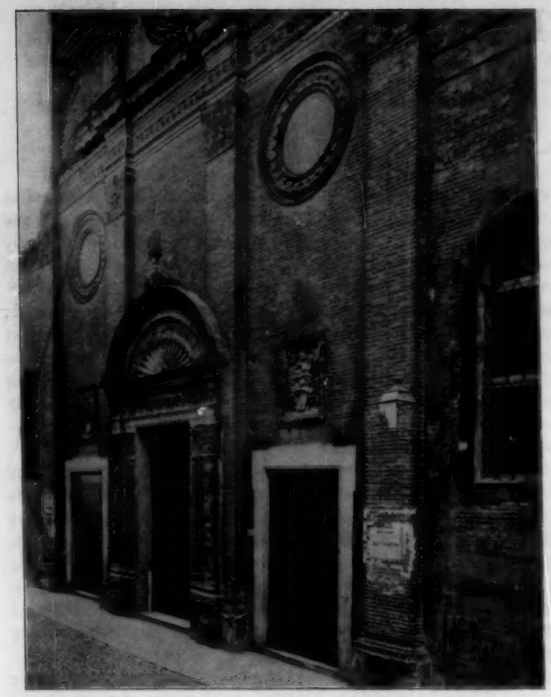
San Giacomo is another example of a modernized church, which has, however, some interesting features. On the exterior there is a rather good treatment of the polygonal apse, with steep gables and pinnacles over the windows on each side. This is somewhat like the apse of San Fermo, at Verona. The campanile on the south-east of the nave is a very lofty late Gothic erection, finished with an incomplete Renaissance belfry-stage. The old portion is divided into a succession of stages of equal height, and is mainly striking on account of its good colour — being all of red brick — and simple outline. The west front is, as is usual here, a great gable divided into three parts by pilasters and half columns; the doorway is of the thirteenth century, and its columns rest on lions' backs. The detail of the windows at the ends of the aisles is extremely good, and seemed to me to be of the same date. The windows are of two lights, with shafts for monials, and a broad transome of plate tracery; the tympanum of the arch at the top is similarly filled: here, though the jambs are of brick, the whole of the rest of the design is executed in stone, and the likeness to some of the later Venetian church windows in the Madonna dell' Orto and SS. Giovanni e Paolo is too great not to be observed. The cornices here are very good. I noticed not only bricks of unusual shapes, very well arranged for effect, but also disks of earthenware, set with the convex side in view, and of brilliant glazed colour, generally blue or green. Their effect is extremely good.



PALAZZO DEL PODESTA, BOLOGNA.

The church of Sta. Maria Maggiore is less

[1] The complete church was to have been 800 feet long, and 525 feet across the transepts, with a central dome 130 feet in diameter.—Fergusson's 'History of Architecture,' ii. 210.



(C) CHURCH OF SAN CATERINA, BOLOGNA.

altered internally than the rest. It is of great length, groined throughout, and in general effect and proportions seemed to me to have a somewhat less Italian air than the other churches. The apse has an aisle and chapels round it of which the brick detail externally is effective. Here there are large tiles cut to a trefoil shape placed flat against the wall-face as an ornament. They are good-looking, but have not stood well.

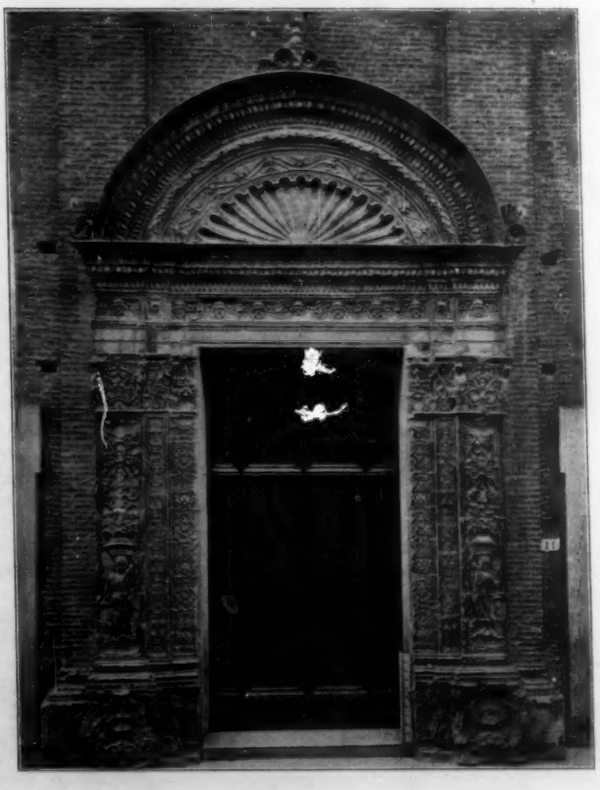
In front of this church there is a court or atrium, surrounded with a perfectly open arcade, which is continued all along the north side of the church next the road and over the public footpath. The columns are very slender and of marble; and though the arches which they carry are segments of circles (not an agreeable form), the whole effect is extremely light and graceful.

San Francesco *was* one of the finest churches in the city. It is now so shabby and decayed outside, and so covered with painters' and decorators' work inside, that all its good effect is ruined. Its interior was the victim of what was, I daresay, a very well-meant restoration some years ago, and little of it has been left in its original condition. It has a chevet with aisles and chapels, and externally the rare feature (in Italy) of flying buttresses to support the choir vault. They were built by men who had never seen one before, I suppose, and are as crude and misshapen as they well could be.

Two campanili close to each other, south of the choir, group strangely with it in the perspective view. They are unlike in size and design, and illustrate the perfect indifference with which all mediæval architects viewed the gravest departures from laws of symmetry. The larger of the two has rather rich Gothic details, the belfry-stage having traceried windows of three lights with spiral shafts for monials. The gables in this church have large white marble crosses let into them; these are rounded at the ends, and each end has a bright green tile disk inserted. The west front is of the usual description — a great sham front of hideous outline. Most of its windows are lancets, new, but probably copied from old examples, and the doorway under a canopy is of good character.

I have left to the last what, I suppose, is in fact the oldest of the Bolognese churches — San Stefano. It is a collection of seven churches, rather than one church, and, in spite of modernization without end, it is still a most curious and interesting jumble of old buildings. The churches are dedicated to — 1, San Stefano; 2, San Lorenzo; 3, San Sepolcro (a circular church); 4, The Corte di Pilato (a cloister); 5, Sta. Trinità; 6, SS. Pietro e Paolo (with three Romanesque apses); and 7, San Giovanni. No. 3 has an aisle round the circular portion, and was probably a baptistery, and there is still an old ambon in it. One gets fairly puzzled in this nest of queer little churches or parts of churches, and I found but little of architectural — as distinguished from antiquarian — interest in them. The brickwork in the cloister and in some of the external walls is extremely good. Some of the latter are diapered or reticulated on the face with square yellow tiles with dividing lines of red brick, and the cornices are of the same two colours also. In the cloister the columns and inner order of the arches are of stone, the rest of the walls and cornices being of red and yellow bricks, and in one part there is a course of red, green, and yellow tiles alternated. The effect of this work is extremely pretty.

Probably travellers remember Bologna more by its two leaning towers than by any other feature. One comes here however, from either side, after rather a surfeit of this sort of thing. On the one side is Pisa, with its leaning tower, and on the other we may see them at Rovigo, Ferrara, and elsewhere. The soil here is generally bad for foundations, I suppose, and these plain brick towers without any projection at the base are the most ill-contrived constructions for such foundations that one can conceive. In this case it is possible to get views of the two towers which show an apparently impossible



(D) ENTRANCE, CHURCH OF SAN CATERINA, BOLOGNA.

amount of overhanging on the part of the smaller one, and I confess to a strong preference for walking to what one may call the windward side of such an erection! There is no beauty in these towers, their only features being the vast array of putlog holes in their walls, and the machicolated battlement of the higher of the two.

Of domestic buildings of the Middle Ages there are not many remains. The Casa dei Mercanti, though it dates from the end of the fourteenth century, is not pleasing. The front has two lofty pointed arches on the ground story, and a canopied Ringhiera of very poor design above. But as the whole front has been restored, the bricks painted bright red, and the stonework cleaned and repaired, I am disposed to believe very little in the antiquity of any of the details. Certainly I found it not worth sketching, which was the more disappointing as I had heard of it always as a fine building. The Pepoli Palace has some old brickwork and a Ghibelline battlement of unusually picturesque outline. The Piazza Maggiore in front of San Petronio is certainly the best feature in this not very striking city. As always in Italian towns, it must be visited early in the day if it is to be seen to advantage. In the morning it is crowded with fruit and vegetable dealers, sitting under bright-coloured umbrellas;

(E) PALAZZO ALBERGATI, BOLOGNA.

in the afternoon it is *triste* and deserted, save by the cabmen, who pursue the stranger with their importunities. One side of this piazza is occupied by the Palazzo Publico — a large pile of building altogether Gothic in its inclosing walls, I fancy, but they have been so much altered from time to time that not much detail remains. It seems, however, to have been much like the Castle at Mantua in its character, with bold machicoulis at the top of the walls, and a well battered-out base to the whole building. In a tower here there is a window which I engrave, because it shows well how good an effect may be produced by the skilful use of the very simplest materials. The combination of stone with brick adds much to the effect; and though this is in itself a very small and unimportant work, it appears to me to be exceedingly suggestive.

Fire-proofing.

SOME DEDUCTIONS FROM THE EVOLUTION IN FIRE-PROOF CONSTRUCTION.— *Concluded.*

BY CORYDON T. PURDY.

THE Roman architecture was perfectly typical of this massive construction. Government buildings, museums, libraries, and quite often banks, cathedrals, churches, and other important and costly buildings, though not necessarily high ones, both in Europe and America, are quite commonly built on this order, while warehouses, and office and business buildings of all kinds, especially in America, are now commonly built of skeleton construction. It is true that many buildings are of mixed construction and typical of neither one class or the other. It is also true that the one has been evolved from the other by many different changes, no one of which was sufficiently pronounced to make an era. Nevertheless, there are marked distinctions between the two classes.

One is massive, not only in appearance, but in fact, while the other is open and light, even more than it seems to be. One is characteristic of the old in architecture and conservative, while the other is radically new. One is fire-proof, because the construction is everywhere so thick and massive that the effect of a fire cannot be far-reaching, while the other depends entirely upon the good character and perfect indestructibility of the exposed materials used chiefly for the protection they afford to a metal frame which could not alone resist a great fire. One may be constructed simply of incombustible material, which may suffer injury to some extent without the destruction of the building as a whole, while the exposed material of the other must be not only incombustible, but it must also be equally indestructible. Otherwise, even its partial collapse may expose the frame and directly or indirectly bring about the complete destruction of the building. In one the construction is comparatively simple and direct, while the other involves many technical considerations and more or less complicated detail. One is necessarily limited in its application. The character of the materials fixes, to some extent, both the height of the building and the arrangement of its rooms, while the other class is practically unlimited in its application. If the cost can be provided, almost anything can be made.

The massive construction has always been practically and satisfactorily proof against fire, while it has taken half a century to produce an equally fire-proof building of skeleton construction, the first general and well-defined efforts in this direction practically dating with the invention of the rolled beam.

It may be desirable to make a massive construction of the exterior, and a skeleton construction of the interior of a building, or indeed some other combination, but it is, nevertheless, important that these distinctions should be perfectly understood. An apparently massive construction of brickwork, or stone, or concrete, which is not massive in fact, is often a dangerous experiment, when the same materials, particularly in buildings not greatly exposed from without, may confidently be used, if the walls are really heavy, and the construction on the whole is thoroughly substantial. On the other hand, a building of skeleton construction must be designed with more care as to the character of all the materials employed in its finish, and as to the details of their use, or in the emergency of a fire the structure will be found wanting in fire-proof qualities.

Full protection from outside fires depends upon the treatment of the window exposure, upon the choice of materials used in the exterior walls, and if the building has an iron frame, upon the covering and protection of the ironwork used in its exterior construction.

Without question the first is the most important consideration, for it is at once the most dangerous point and the most difficult to meet. Ordinary glass will surely go to pieces if exposed to a great heat. It is a problem not yet solved. The common practise of using outside shutters of sheet iron, or of wood covered with iron, on

windows facing alley and court and in rear elevations, has been even in these places of but partial advantage. It is practically impossible for owners to compel tenants to close them, and it would add from 2 to 5 per cent. to the expense of operating some buildings if the owner tried to do it. It would also require the employment of several men, even in an ordinary building, if they are to be closed as soon as offices are vacated. If the fire occurred in the daytime, the chances are quite possible that circumstances would prevent their being closed. It is true that they may be made effective on very large windows on the ground floor and in exceptional cases elsewhere; but generally considered, on street fronts exterior shutters are undesirable because they destroy the architecture of the building and in show windows prohibit their use as such except during business hours. Interior rolling shutters have been used to a considerable extent and there is much to say to their advantage. It would seem that the solution of the problem must depend upon their adoption, or upon the invention of a glass that will resist the efforts of heat. In many fires the wooden sash and wood window frames have been the first things to take fire, when the glass would otherwise have withstood the exposure. This difficulty, however, is now easy to meet, for both the frames and the sash can now be covered with metal by American manufacturers so neatly and so well that they are scarcely discernible from the wood itself.

The choice of materials for exterior walls is particularly important when the exposure is as great as it ordinarily is in city construction. Granite, marble, and limestone, and also some sandstones, will go to pieces if badly exposed, and will be injured with even slight exposure. If iron is used in the construction of the wall, its covering and protecting is doubly important. An indestructible material should always be used. The too common practise of covering iron columns in exterior walls with a few inches of marble, or granite, or of any kind of stone without other indestructible material intervening, is so radically wrong that it should be prohibited by law in every large city. Hard burned clay material in the form of brick or hollow porous fire-proofing seems to be the only absolutely reliable material for the purpose. The protection of brickwork was shown by an experiment in Vienna in 1895. This was described in THE BUILDER, in a July number of that year as follows: "Experiments were made a short time ago in Vienna, under the supervision of the city surveyor, with the object of testing the efficiency of various building materials against fire, and also to ascertain what protection they were capable of affording to ironwork. To make these tests a brick chamber some 12 ft. by 8 ft. in plan and 11½ ft. high was built, and in the center an iron column was constructed consisting of two channel bars, 5½ by 2¾ ins. These channels were placed 2½ ins. apart, back to back, and were braced together with light lattice bars. Within the space between the channels, test bars, composed of various alloys melting at temperatures between 150 degs. Fahr. and 1,650 degs. Fahr., were placed, the column afterwards being surrounded with brickwork in mortar, thus forming a pier some 18 ins. square. In order that the test should, as nearly as possible, resemble the conditions met with in actual practise, the column was loaded with a sufficient weight to cause a stress of 3¼ tons per square inch on the ironwork. Fuel was then strewed over the floor of the chamber to a depth of some 3 ft., and the firing was fully maintained for a space of two and a half hours and was subsequently extinguished by the fire brigade. The heat had, however, been so great that it was not until the next day that a thorough examination of its effects could be made, but it was then discovered that although the edges of the brickwork pier were crumbled to an extent of 1½ ins., the iron column was quite uninjured, and only the test bar, capable of fusing at 150 degs. Fahr., showed any indication of melting. It would thus appear that the brickwork was of ample thickness to protect the ironwork, and that when such construction is adopted in actual practise a building is probably as fire-proof as it is possible to make it."

The problem of protecting a building from the spread of an internal fire is more complicated. Destruction or material injury on this account may be due to one or more of the following causes: —

1. Fire-proofing materials and combinations, one or both, which are not indestructible, though the material may be incombustible.
2. An excess of combustible material in trimming, wainscoting, doors, floors, etc.
3. Ordinary glass windows for borrowed light in partitions.
4. The support and division of fire-proof partitions with wooden frames.
5. Continuous openings over large areas under wood floors.
6. The imperfect covering of the bottom flanges of beams or other ironwork in floors not necessarily protected by the regular arch construction.
7. The imperfect covering of columns.
8. The imperfect use of granite, marble, and other such materials.

In any of these particulars a mistake in design or faulty workmanship may lead to great loss in an otherwise perfectly fire-proof structure.

The material used in floors and partitions must be indestructible. Simply incombustible material will not do. It should be able to endure heating to a temperature of 2,000 degs. Fahr. and cooling again either slowly or quickly without crumbling or cracking. Indeed, all its physical conditions should remain unchanged by this treatment, including its strength as a building material.

The result should be the same, whether a whole section of the material is subjected to test, or only one surface of it. As a matter of fact, in the actual test of a fire in a building, it is generally one side only that is exposed. All fire-proofing materials expand under heat and contract again on cooling. It is owing to this fact that partial heating may shatter material which might remain uninjured if fully heated. In burned clay materials it is quite as much a question of the skilful shaping of the walls as it is of the material itself. It must not be forgotten, however, that it is the partition as a whole or the floor completed that must be indestructible, and that it is, therefore, quite as much a constructive question as one of material or of skilful manufacture. Otherwise good terra-cotta partitions have been thrown down in fires because the blocks were not well bonded together, or the adhesive qualities of the mortar were destroyed. It may be considered proper to call any building in which wood is not mainly relied upon a fire-proof building, for architects generally and manufacturers use the words that way. In such buildings wooden frames are conveniently used in the construction of partitions. Such fire-proof buildings burn. If a real fire-proof building, one that will not burn, is intended, wood should never be used constructively in partitions, or in floors, or anywhere else. It cannot possibly be employed without danger. A partition cannot be too well put together, or too strong laterally, as viewed from the point of fire resistance. If its strength is great enough to resist the possible exigencies of a bad fire it should be strong enough for any purpose. The contrary is equally true of a floor. If that is built well enough and strong enough for utility it should be strong enough to resist fire.

The elements, then, of a perfect terra-cotta partition are these: —

1. A material which is uninjured by 2,000 degs. of heat, or the subsequent cooling, however it may be.
2. Walls in the block thick enough to resist the effects of unequal expansion and contraction.
3. Mortar which will also endure great heat without destruction.
4. Thoroughly good workmanship in erection.
5. At least four inches in thickness before plastering.
6. Iron framing for all openings, the side pieces extending from the floor to the ceiling if the openings are for doors.

Injury in a terra-cotta constructed floor on account of the expansion and contraction of the material is more likely than in a partition. Its resistance depends upon the use of porous material and skilful designing, though clays vary so greatly that it is not possible to say that no hard burned clay can be made to serve the purpose.

Good partitions and floors are made of other materials, but none that have so fully filled the requirements as those made of terra-cotta. Concretes of all sorts are so dependent upon good workmanship that generally that factor becomes the most important element of their success. Considerations of time, expense, moisture, resistance to sound, etc., may not be involved in their fire-proof qualities, but they may have much to do with determining their use or rejection.

Next to the use of wood in the construction of terra-cotta partitions, the use of ordinary glass in openings for borrowed light has probably permitted the spread of fires in office buildings more than any other one thing. Glass is now manufactured which will preserve its integrity under the severest treatment. If iron sash or iron-covered sash are used, there is therefore no reason why these openings should not prevent the spread of destruction equally with the body of the partition. Sash doors and trimming of all kinds are now made in the form of metal-covered ware, which will keep its perfection of form indefinitely, and which is an almost perfect imitation of woodwork. Its extensive use is to be urged wherever the best work is desirable. It reduces the inflammable material upon which the fire can feed, which cannot fail to be of advantage. It hardly seems necessary to do away with wood-finished floors, even in the best buildings, but they should be laid so that there is no opening underneath, and especially so, over large areas. If properly constructed they can burn but slowly, even if the fire is great. When everything else in a room has been consumed the floors often remain after a fire only partially destroyed.

The covering of the bottom of the beams in the ceiling is often very badly done. It has been a difficult detail to satisfactorily meet. Nothing yet used has fully satisfied the demand. It is all practically dependent on good workmanship, which is hard to get, especially in such a small detail. The adoption of metal in certain forms supplementary to the arch material may finally prove the best solution. In any case the covering should be substantial and should provide an air space under and around the structural iron protected.

The best covering of columns is also still a disputed question. Here the problem of protection from corrosion is even more important than that of fire. The covering should thoroughly protect the metal from moisture at all times, and from heating in case of fire. It is therefore necessary that it should be strong in itself so that the fire and the water, the destruction of adjoining constructions, or falling bodies cannot throw it down or pull it off. Slabs of marble or granite, or other material, is of course unsuitable for this purpose. If used at all about columns, it should always be without reference to protection.

A fire of internal origin in an office building may be expected to destroy the contents of the room, the finishing woodwork in floors and walls, and the decorations, but if it is built as well as it can be the fire ought not to spread to adjoining rooms.

The treatment of department stores and warehouses, where the openings extend over very large areas, is a more difficult matter. It seems as if there can be no safeguarding the contents of such great rooms, or even of a whole building, where floors are open to each other through large vertical spaces. It may be that some system of partitions made of metal and movable may be made to divide the space at night and reduce the risk.

The stairways in every large building should be made of solid metal, both treads and risers. No point needs more to be relied on to the very last in a great fire, and no place will yield quicker than a stairway with marble treads. The possibility of making a strictly fire-proof building, even by our most modern methods of protected steel frames, is now a demonstrated certainty. The problem of the future is to so improve on these methods, or to so cheapen them, that their use in dwelling houses, apartments, and tenements will become general. Efforts in this direction cannot fail to hasten the day when the law in several of our largest American cities will make fire-proofing methods compulsory in buildings of all kinds, prohibiting the use of wood entirely, except for temporary use and as a finishing material. The work that has been done is great enough, but there is a greater still unfinished.

Brick and Terra-Cotta Work in American and Foreign Cities, and Manufacturers' Department.

NEW YORK. — It is very gratifying to note that although the prices of most building materials have gone up and that building costs at least 15 per cent. more than last year, there has been unusual activity all summer; in fact, in some localities the record of new buildings exceeds that of last summer.

A unique ceremony which has provoked considerable discussion was celebrated in this city a few weeks ago, when a bronze tablet was placed at the entrance to the Tower Building, No. 50 Broadway, to commemorate and establish for future time the record of the erection of the first skeleton construction building in the United States. The era of high buildings began in 1870. The "cage" construction, by which is meant a framework of iron and steel columns and girders which carry the floors only and do not carry the outer walls, developed the first high buildings, but the Tower Building inaugurated the fullest departure, being of "skeleton" construction, or a framework of iron or steel columns and girders which carry the weight of the outer enclosing walls together with the floors down to the foundations at initial points. A Chicago architect made a claim of priority, but the *Record and Guide* gives abundant proof that the Tower Building, designed by Mr. Bradford L. Gilbert, is entitled to the honor.

A tenement-house exhibition is to be held in this city in December, under the auspices of the Charity Organization Society, at which it is proposed to present all phases of the tenement-house

RESIDENCE, FIFTH AVENUE, NEW YORK CITY.
McKim, Mead & White, Architects.

CAPITAL FOR UNION STATION, DAYTON, OHIO.
Executed by the St. Louis Terra-Cotta Company.
Elsner & Anderson, Architects.

problem. It is apparently the intention to show the good and the bad tenement houses by models, and if this is done fairly, it will form a very useful and instructive exhibit from the technical as well as the sociological point of view. In this connection it is interesting to note that the tenement-house population in New York is smaller by 10,800 than it was a year ago. A reasonable theory seems to be that the larger part, if not the whole, of the lost tenement population has migrated to the suburbs, particularly in the Bronx and Brooklyn boroughs. Agents for suburban property say that most of the inquiries received in response to advertising come from people who live in Manhattan flats. Prospects of greater privacy, larger quarters, and the possibility of becoming their own landlords prove strong attractions to flat-house tenants, who are consequently seeking the frontiers in considerable numbers. Besides, laborers employed in constructional work naturally migrate to the chief seats of speculative building. In the line of big deals nothing is more interesting than the rumor that William Waldorf Astor is to sell all his holdings in New York City; a truly princely array.

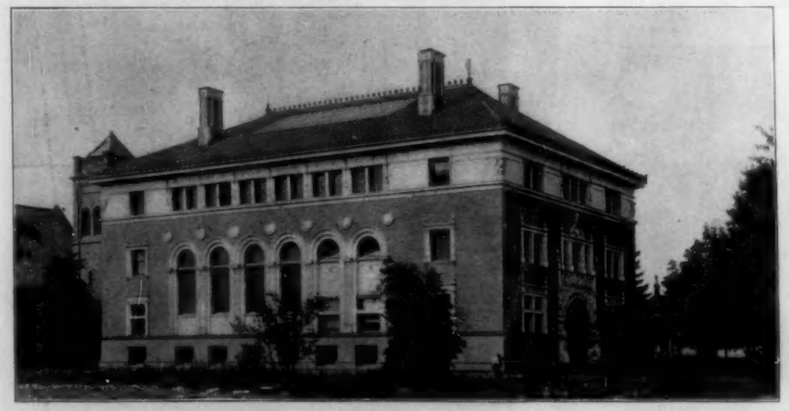
Thomas Graham has planned four six-story brick and stone apartment houses to be built on 89th Street, at a total cost of $400,000. The architect is also owner and builder. Clinton & Russell are preparing plans for a five-story brick and stone residence to be built on East 78th Street; cost about $50,000. George F. Pelham has prepared plans for two six-story brick store and flat buildings on First Avenue, at a total cost of $60,000. George Keister is at work upon plans for a ten-story brick and stone apartment building to be erected at 92d Street, corner Central Park West, at a cost of about $600,000. Louis Korn has prepared plans for a nine-story brick hotel to be erected on Madison Avenue, corner 92d Street; cost, $350,000. F. T. Camp has prepared plans for a seven-story brick flat and store building, to cost $200,000, and to be erected on Amsterdam Avenue, corner 79th Street.

CHICAGO.—A strange fatality seems inherent in the name "Coliseum" when applied to buildings here. The recent appalling disaster in which the trusses of the new Coliseum, on Wabash Avenue, went down, killing twelve men and seriously injuring as many more, is the third event of a series which causes superstitious people to shake their heads. The first Coliseum, in which the last Democratic National Convention was held, collapsed during the erection of the framework and several lives were lost. Less than two years later it was totally destroyed by fire. In the present instance the exact cause of the wreck has not yet been determined.

SPANDREL FOR BINGHAM HOUSE, PHILADELPHIA, PA.
Executed in terra-cotta by the Conkling-Armstrong Terra-Cotta Company.
Willis G. Hale, Architect.

The coroner's jury has fixed the blame on the Pittsburgh Bridge Company, but only a searching expert investigation will settle the question of responsibility. The steel structure was designed by E. C. and A. M. Shankland, the well-known engineers; the auditorium being spanned by twelve arches of 150 ft. span and 66½ ft. rise. They were of the three-hinged type, similar to those in the Manufacturers and Liberal Arts Building at the World's Fair. It has been suggested that a rope from the hoisting engine to the traveling crane caught in the north truss and toppled it over, the purlins and diagonal bracing not being completed at that end of the building. The north arch fell to the south, and the others went down like a row of cards.

It is interesting to note here and there in the ornamental detail of new buildings, attempts to follow the rich and involved motives, for the invention and development of which Mr. Louis Sullivan has been given so much well-deserved credit. It is to be hoped that this exquisite and highly organized style will have many intelligent and original disciples, able to create and differ-



WESTERN RESERVE HISTORICAL SOCIETY BUILDING, CLEVELAND, OHIO.
Spanish tile for roof made by J. C. Ewart & Co.
F. S. Barnum & Co., Architects.

CAPITAL AND COLUMN, SECOND STORY, NEW YORK MEDICAL COLLEGE AND HOSPITAL FOR WOMEN.
Executed by the Excelsior Terra-Cotta Company.
Wm. B. Tuthill, Architect.

entiate on similar lines according to their several individualities; not depending for ideas, as seems to be the case with some at present, upon the remarkable skill of one or two modelers who are past masters in the interpretation of Mr. Sullivan's rough but highly suggestive sketches. The multiplication of buildings in this style will, if they are intelligently done, do much to give a strong local character to our architecture.

It is surprising that there are not more modern transient hotels and lodging houses to accommodate the large number of down-town lodgers of humble means who are at present very poorly cared for. Work has recently been begun on a model building for the above purpose, on Van Buren Street, between State Street and Wabash Avenue. It is also rumored that a scheme is on foot to erect a larger building for similar purposes, modeled after the Mills Hotels in New York City. It would work great improvement in one of the most unsightly and unsavory sections of the city if some of the old buildings in the "Levee" district could be torn down and one or two large hotels of this class erected in their stead. While nearly all large American cities are rather dilapidated and unsightly in their depot neighborhoods, it seems as though Chicago were particularly so. There is no good reason why our depots should be surrounded by saloons, slums, and ugly buildings, nor why the streets leading to them should be so dirty and disreputable that people of refinement hesitate to walk through them, especially after dark. The city of Milwaukee is a pleasing exception in this respect, both of her stations (the St. Paul and the Northwestern) being rather pleasing modern structures, each of which faces a well-kept park. Strangers arriving receive at once a happy first impression. When one considers the fact that our railways are the great public highways by which many thousands enter our great cities every day, it seems rank carelessness and short-sighted indifference to permit these highways to be lined with squalid habitations, ill-kept manufacturing plants, and an infinitude of unsightly signs and billboards.

The Chicago Architectural Club has published in a neat little booklet a general code governing competitions in design, which was adopted by the club last April for its own competitions. It is prac-

PEDIMENT OVER THIRD STORY WINDOWS, NEW YORK MEDICAL COLLEGE AND HOSPITAL FOR WOMEN, NEW YORK CITY.
Executed in terra-cotta by the Excelsior Terra-Cotta Company.
Wm. B. Tuthill, Architect.

BALCONY BRACKET, 4 FT. 2 INS. PROJECTION. REAL ESTATE COMPANY'S BUILDING, PHILADELPHIA.
Work executed by the New York Architectural Terra-Cotta Company.
Edgar V. Seeler, Architect.

RESIDENCE, NEW YORK CITY.
S. M. Holden, Architect.

HOTEL SCHENLEY, PITTSBURGH, PA.
Rutan & Russell, Architects.

tically identical with the codes adopted by the other leading architectural clubs. The club will use its best endeavors to get copies of the code into the hands of building committees and individuals who are about to ask for competitive designs. The first competition to be held under the code will soon be announced. The prizes offered will amount to $1,000, and will be given by a certain local bridge company for the architectural treatment and ornamentation of a proposed new bridge across the Chicago River. It is to be hoped that the competition will show more ability in handling unusual problems in design, where precedent counts for less than originality and logical invention than was evidenced in the Luxfer Prism competition of last year, in which the majority of competitors were so bound to precedent that their suggestions were of little value. The excessive rise in cost of building, taken in connection with the still stationary condition of land values, tends to hold all speculative building very much in check. A marked rise in land values accompanied by a reasonable drop in prices of building materials, where there has been a forced inflation, ought to result in great building activity next year.

BEGGS BUILDING, COLUMBUS, OHIO.
Front of enameled brick and glazed terra-cotta, furnished by the Tiffany Enameled Brick Company and the American Terra-Cotta and Ceramic Company.
C. A. Stribling, Architect.

BOSTON.—Thus far this year the building operations in Boston show a considerable gain over those for a corresponding period last season, the building permits issued for brick buildings up to Sept. 1, 1899, being 467, as against 317 issued up to Sept. 1, 1898. This gain represents much more than a mere numeral increase, as the buildings represented by this year's permits are, generally speaking, operations of considerable more magnitude, and average a much higher cost than those of last season. The outlook, as far as can be estimated, is for a continued activity of this class of building, for some months at least, as the projected new enterprises of this character are considerable.

DETAIL, CHAMBER OF COMMERCE BUILDING, CLEVELAND, OHIO.
Executed in terra-cotta by the Northwestern Terra-Cotta Company.
Peabody & Stearns, Architects.

At the present time there is a marked absence here of speculative building. In consideration of the heavy losses attendant on such schemes during the past three years, the building material concerns are rejoiced at the healthy, legitimate enterprises that now occupy their attention. In fact, speculative schemes receive but little or no consideration at their hands.

While there is a good demand for burnt clay material, amounting in some lines to almost a shortage, there has not been a proportionate rise in prices of same; these materials selling at within 5 or 10 per cent. of the figures of last year. It is generally conceded by manufacturers and dealers that these prices are by far too low, as the

PANEL FOR GRINNELL APARTMENTS, DETROIT, MICH.
Executed by the Indianapolis Terra-Cotta Company.
Edward C. Van Leyen, Architect.

HOUSE AT CHICAGO, ILL.
Built entirely of terra-cotta made by the American Terra-Cotta and Ceramic Company.
Jennie & Mundie, Architects.

cost of production in these lines has heavily increased within eight months. It is confidently expected that owing to these conditions some advance will naturally arise in these materials by January 1. Boston is following the example of other large cities in forming a brick trust to include all the common brick plants in New England. The prospects are favorable of such a combination being made within thirty days. The completion of the South Terminal Station, and the great tide of travel in its immediate section which its occupancy by four lines of railroad has produced, has caused many changes in the commercial character and value of streets leading to it. What was formerly a neighborhood devoted exclusively to the wholesale trade is now being rapidly converted into a retail district. With this has followed much alteration in the character of buildings in this vicinity: many old buildings have been remodeled, or taken down and replaced by structures suitable to the new conditions. It is probable that within the next two years much new building will be done thereabouts.

TERRA-COTTA PANEL, APARTMENT BUILDING, NEW YORK CITY.
Executed by the White Brick and Terra-Cotta Company.
David W. King, Architect.

NEW CATALOGUE.

WE are in receipt of a pamphlet composed of the "advanced sheets" of a catalogue, now in press, which is shortly to be issued by the Central Fireproofing Company. In publishing this work, the aim has been to compile a treatise that should far exceed the limitations of a mere catalogue, and by means of it supply the architect, the engineer, and the contractor with a handbook on the subject of the fire-proofing of buildings, which will occupy the same relative position as the handbooks published by the rolling mills concerning steel structural work, etc. It will also furnish the insurance companies, the investors in real estate, and such of the public as are interested in building operations, with the means of investigating the strength and the refractory qualities of burnt clay fire-proofing, and in obtaining other necessary information concerning fire-proofing materials. The work, as far as published, is a most successful endeavor to treat the subject generally in a scientific way, and will be of great service to architects and builders in estimating on the employment of this material in building construction. Parties desiring a copy of this pamphlet should communicate with the Central Fireproofing Company, 874 Broadway, New York City.

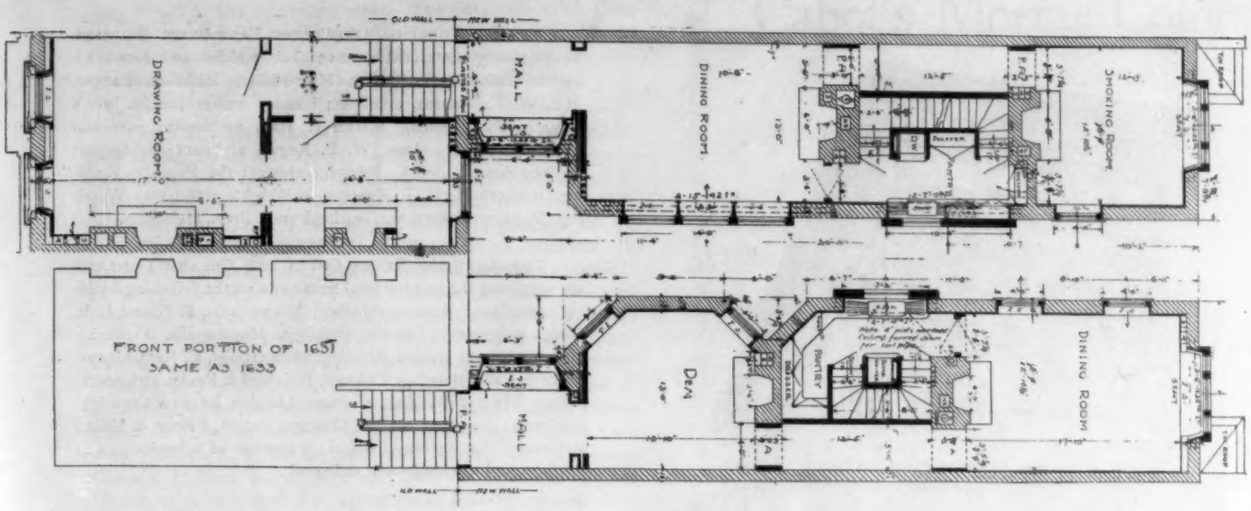
METHODIST ORPHANS' HOME, ST. LOUIS, MO.
Brick furnished by the Hydraulic-Press Brick Company.
T. B. Annan, Architect.

CURRENT ITEMS OF INTEREST.

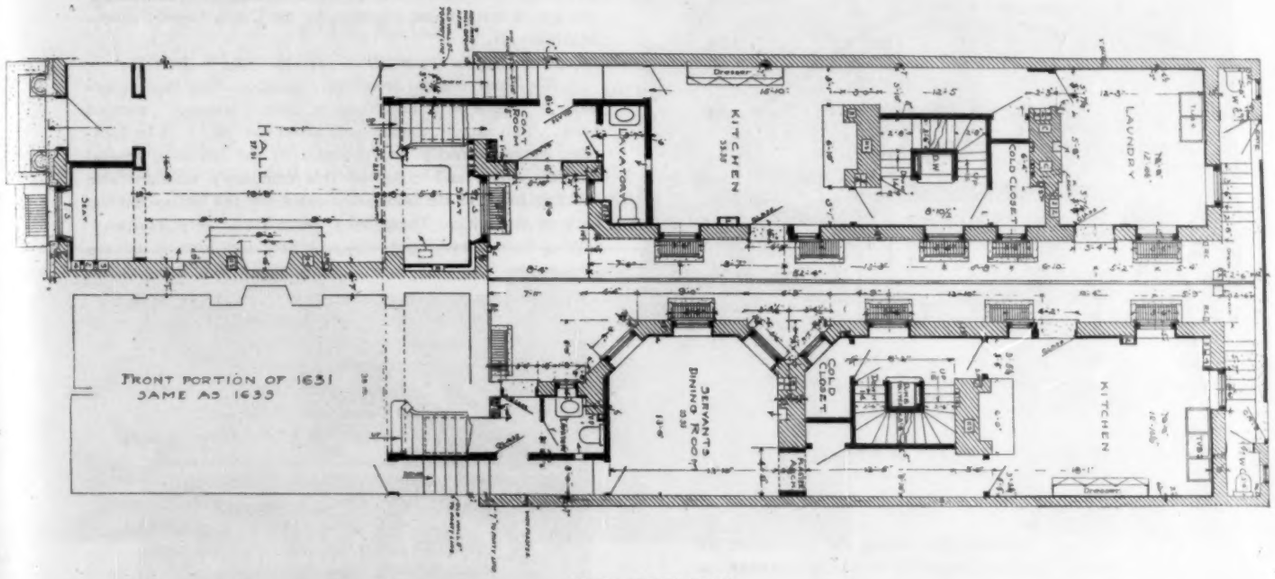
JAMES A. DAVIS & Co. are furnishing large quantities of Lehigh Portland Cement for the gun batteries at Fort Greble, and other important government work in Newport Harbor, R. I.

THE ROBERT AITCHISON PERFORATED METAL COMPANY report numerous orders for their screen material from the brick manufacturers. This company carries in stock a complete assortment of suitable sizes for such work.

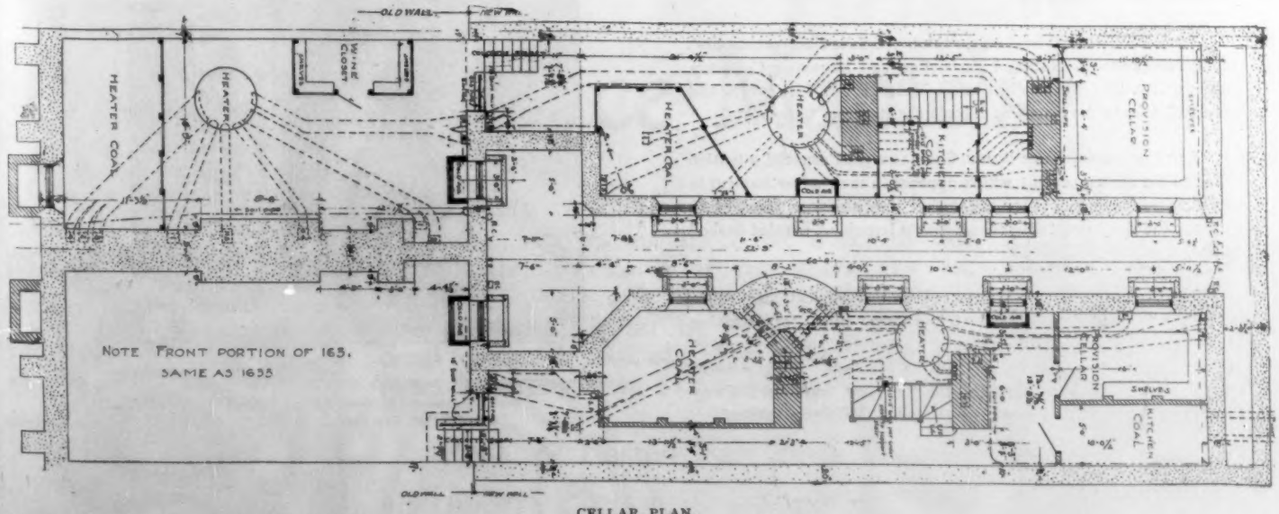
THE AMERICAN MASON SAFETY TREAD COM-



SECOND FLOOR PLAN.



FIRST FLOOR PLAN.



CELLAR PLAN.

PLANS, HOUSES AT PHILADELPHIA, PA. (ELEVATIONS SHOWN IN PLATE FORM.)
Cope & Stewardson, Architects.

BUSINESS BLOCK, BROADWAY, NEW YORK CITY.
Built of gray speckled brick, Roman shape, manufactured by the Columbus Brick and Terra-Cotta Company.
J. B. Snook & Sons, Architects.

PANY report that over forty buildings in process of erection in Boston, or plans of which are now on architects' boards, have Mason Safety Tread or Mason Safety Sidewalk Light specified.

E. E. NICKSON, who has been representing the interests of the Pittsburgh Terra-Cotta Lumber Company in Boston, will assume, on October 1, the position of general sales agent for that company, with headquarters in Pittsburgh.

ANTHONY ITTNER, St. Louis, reports the following recent sales: 500,000 bricks to the National Enameling and Stamping Company, Granite City, Ill.; 250,000 bricks to Miller Bros., Pittsburgh, and 250,000 bricks to the Southern Illinois Construction Company.

THE COLUMBUS FACE BRICK COMPANY wish especial attention called to the announcement which appears in their advertisement in this issue (see page xv), to the effect that they are now prepared to contract for the prompt delivery of their "Ironclay" mottled flashed brick.

THE POWHATAN CLAY MANUFACTURING COMPANY are furnishing their "Salt and Pepper" and "Silver Gray" bricks for the facing of the North Carolina University, at Chapel Hill, N. C., Frank P. Milburn, architect; 160,000 bricks will be required. Their "Silver Gray" brick have been specified for the New Southern Railway Passenger Depot, at Richmond, Va., Frank P. Milburn, architect.

THE PHILADELPHIA AND BOSTON FACE BRICK COMPANY have recently contracted to serve their molded and face brick on the following contracts: Morse-Oliver Building, Bangor, Me., W. E. Mansur, architect; interior arches for St. John's Church, East Boston, Martin & Hall, architects; parochial school, Lawrence, Mass., W. P. Regan, architect; Bridgeport Orphan Asylum, W. C. Briggs, architect; the Franklin Building, Rutherford, N. J., Rossiter & Wright, architects; Woodruff Building, Columbus, Ga., Lockwood Bros., architects.

THE AMERICAN TERRA-COTTA AND CERAMIC COMPANY are supplying the architectural terra-cotta on the following building operations: Andrus Building, Minneapolis, F. B. and L. L. Long, architects; Tribune Building, Minneapolis, Frederick Kees, architect; Albion Building, Minneapolis, E. Kennedy, architect; Cable Building, Chicago, Holabird & Roche, architects; Edison Electric Building, Chicago, Shepley, Rutan & Coolidge, architects; Scoville Building, Chicago, Patton, Fisher & Miller, architects; the Marine Hospital; a number of schoolhouses at Chicago, and a schoolhouse at Detroit.

THE AMERICAN ENAMELED BRICK AND TILE COMPANY have closed a contract with Dwyer & Huntington to furnish 70,000 glazed brick in one shipment, for the Union Depot Subway, at Albany, N. Y.

WE have received from the Columbus Face Brick Company a sample in a new form of their "Ironclay" mottled brick. This sample, though only about one half inch in thickness, shows correctly and conveniently the full face, general mottled effect, and color of this company's standard size building brick in the shade indicated by the stamp on the back of the brick. These brick are made in several shades, varying from a very light ivory to a very dark bronze, and are

ENTRANCE, PIAZZA & BOTTO BUILDING, VICKSBURG, MISS.
Terra-cotta executed by Evens & Howard Company.
Alfred Zucker, New York City, Architect.

carried in stock by the company in very large quantities in the standard and Roman sizes, together with an assortment of "shapes" and "ornamentals," illustrations of which will be sent by the company to any parties requesting same. The Columbus Brick Company lay great stress on the fact that their brick are a product of a *natural combination* of fire clay with two elements of iron, and contain no artificial mixture or injurious substance whatever.

THE CELADON TERRA-COTTA COMPANY, LTD., will furnish their roofing tile on the following building operations: Residence at Atlantic City, H. G. Adams, architect; residence for George Lee, Beverly Farms, Mass., W. G. Rantoul, architect; residence for W. H. Heller, Easton, Pa., H. W. Liggett, architect; residence for Susanna Curtiss, Chicago, B. Z. S. Davis, architect; residence for J. R. Raymond, Stamford, Conn., Charles A. Rich, architect; residence for W. W. Candys, St. Louis, Weber & Groves, architects; residence for C. H. Weaver, Chicago, Postle & Postle, architects; residence for G. P. Everhardt, Highland Park, Ill., F. P. Burnham Company, architects; residence for Henry Cline, Blue Island, Ill.; Municipal Building at Passaic, N. J.; high school, Harvey, Ill., Oscar L. McMurray, architect; Memorial Baptist Church, Chicago, Patton, Fisher & Miller, architects; building for Hastings Express Company, Chicago, G. O. Garnsey, architect; Marine Hospital Building, Chicago, J. Knox Taylor, architect; Zeta Psi Fraternity Building, University of Michigan, Ann Arbor, Mich., John Eisenmann, Cleveland, architect; Normal Park Railroad Station, Chicago.

FOR SALE.

WHITE CLAY MINE, TWENTY ACRES. SAYLORSBURGH, MONROE COUNTY, PENN., INCLUDING OUTBUILDINGS, ETC., NOW IN OPERATION, QUARTER OF A MILE R. R. TRACK, CLAY SUITABLE FOR TILING FANCY BRICK. SOLD ON ACCOUNT OF OTHER BUSINESS. OFFER WANTED. ADDRESS FOR PARTICULARS, RUSTEN & ROBBINS, 24 COURT ST., BROOKLYN, N. Y.

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BRILLIANT, DURABLE, RELIABLE

Not the lowest priced, but so strong and durable and so easy to work that they are actually the cheapest. Used fifteen years by people who insist upon *quality*.

Cabot's Brick Preservative

The only waterproofing for brickwork that is permanent. Three times as waterproof as linseed oil, and goes farther. Prevents water-soaked walls, efflorescence and disintegration by frost.

Send for circulars and prices.

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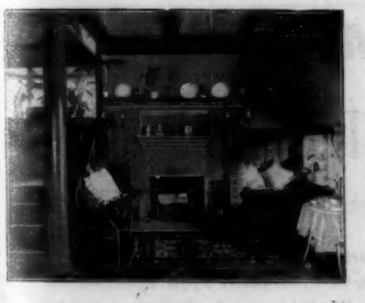

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Phila. & Boston Face Brick Co.,

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THE OLD COMPARED WITH THE NEW.

The credit belongs to the Welsh of first making roofing plate which has performed so large a part in sheltering humanity for so many years. The old Welsh method of making tin plate was an honest one, but it had its crudities and imperfections.

The art of making the best tin plate has progressed, as have all other arts, so that the best product of to-day is superior to that made by the old Welsh method. The superiority of the best modern plates lies largely in the thoroughly even distribution of the coating metal over the black sheet. This is an important thing for every buyer or user of tin plate to know.

Messrs. MERCHANT & CO., Inc., of Philadelphia, New York, and Chicago, who have for so long a time made a specialty of the highest grade of plates, have contributed some valuable literature on this material within the last year, viz.: their booklet, "HOW ROOFING TIN IS MADE" and "HOW A TIN ROOF SHOULD BE LAID"; but not less interesting and valuable is their latest issue entitled "NOT JUST AS GOOD, BUT ACTUALLY BETTER," which minutely describes the difference between their method of making plates and the old Welsh method. It will afford them pleasure to mail any one, or all three, of these little works to any name and address sent them to Philadelphia, New York, or Chicago.

Roof Cement

(SILK FIBER BRAND),

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MORTAR COLORS,

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CLINTON, NEW YORK.

Write for Illustrated Catalogue.

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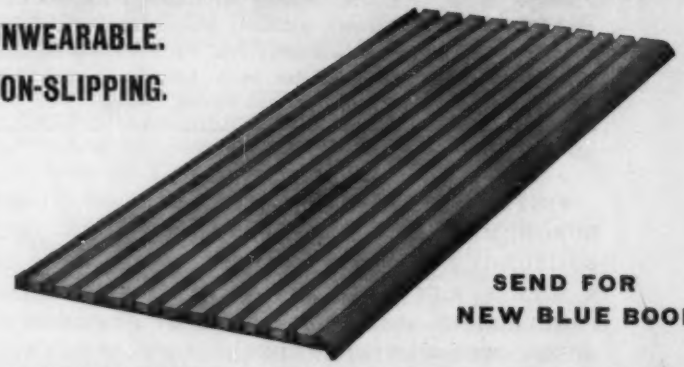

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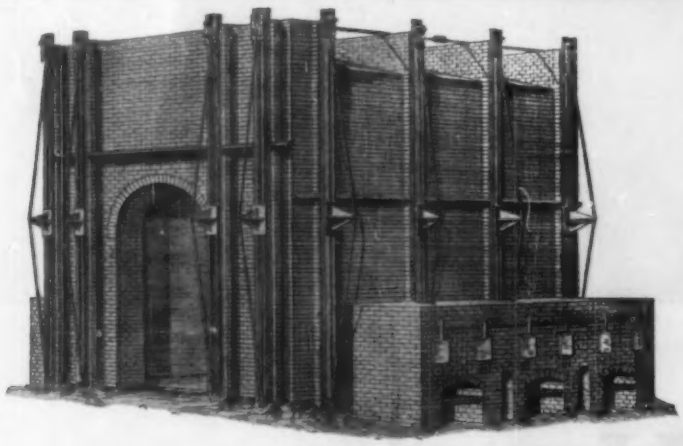
NEW BLUE BOOK.

AMERICAN MASON SAFETY TREAD CO., BOSTON, MASS.



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is the most perfect system of burning. Guaranteed output, over 95% of **first-class face brick.** Our Coking Furnace can be attached to any kind of kiln.

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is the simplest, most powerful, and durable press for making plain, press, and ornamental brick from dry or semi-dry clay in the market.

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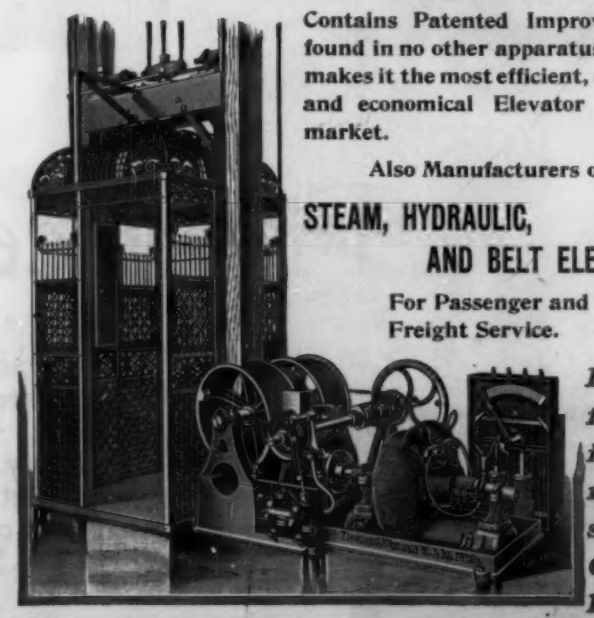
FOR PASSENGER and FREIGHT SERVICE,



Contains Patented Improvements found in no other apparatus, which makes it the most efficient, durable, and economical Elevator on the market.

Also Manufacturers of

STEAM, HYDRAULIC,
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For Passenger and Freight Service.

For further information send for Circular E.

Moore & Wyman Elevator and Machine Works,

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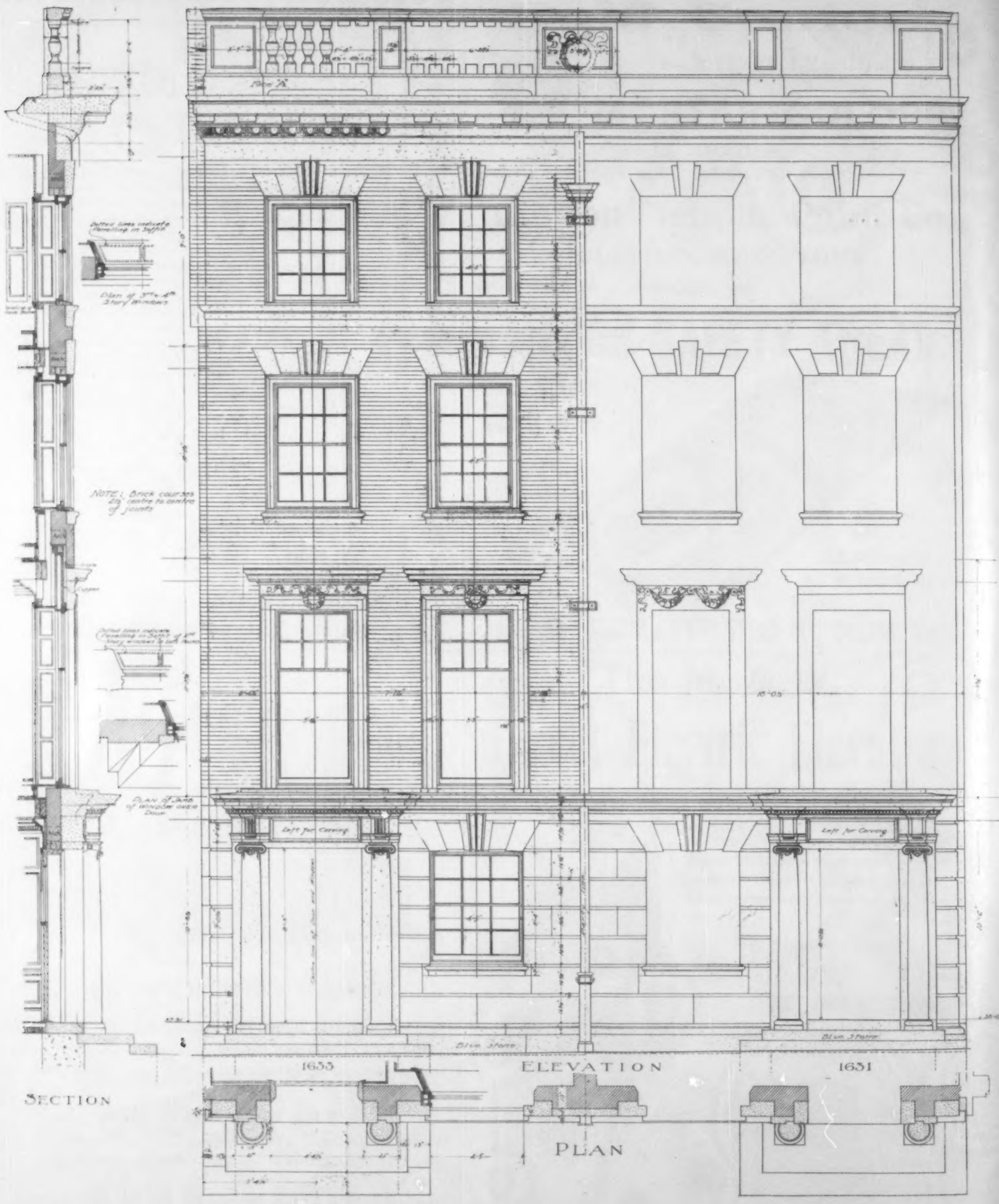
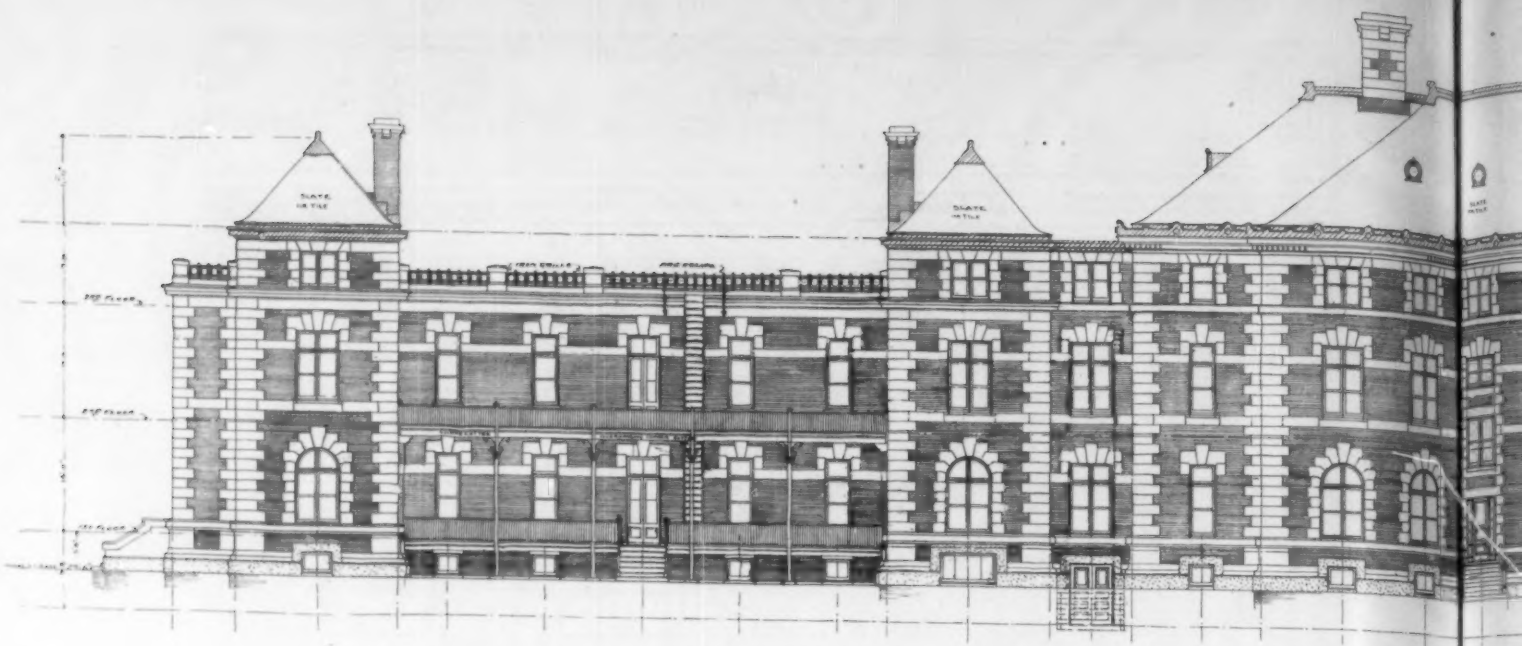
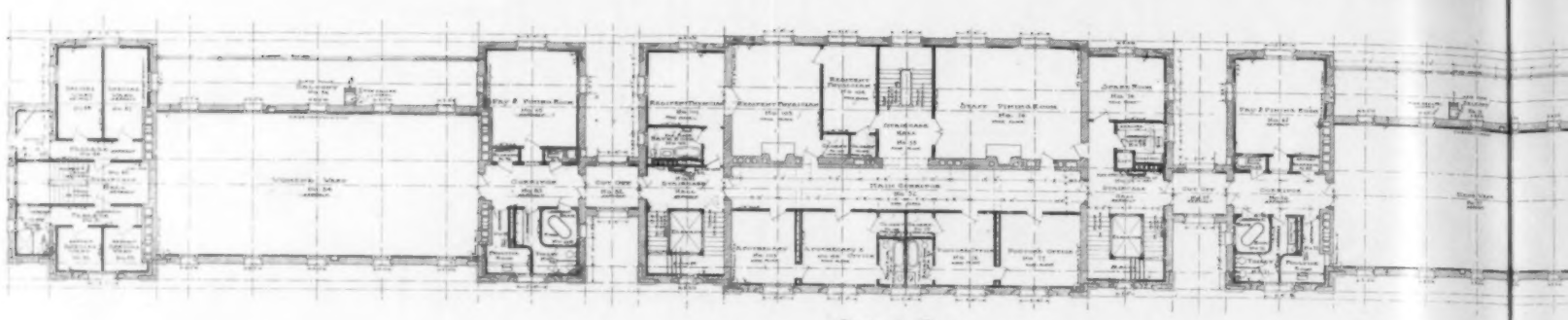


HOUSES AT PHILADELPHIA, PA.

COPE & STEWARDSON, ARCHITECTS.

(Floor plans shown in letter-press of this number.)





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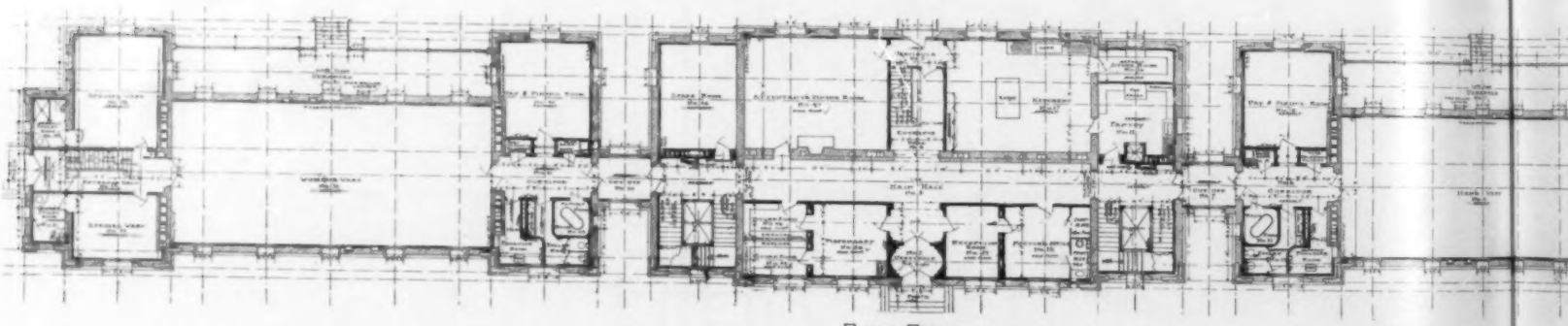

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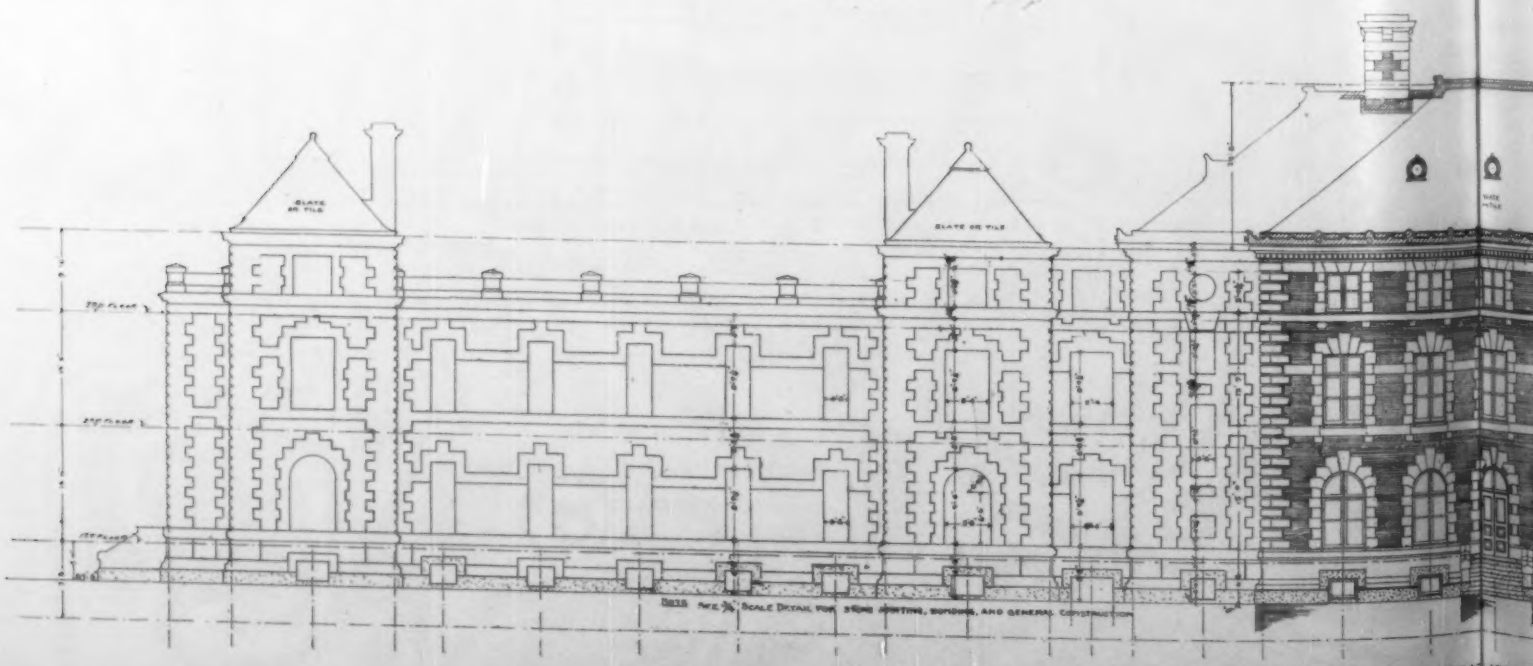
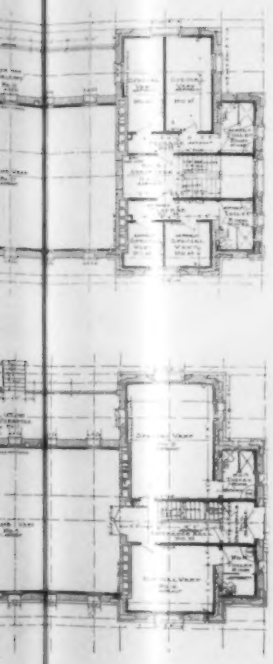
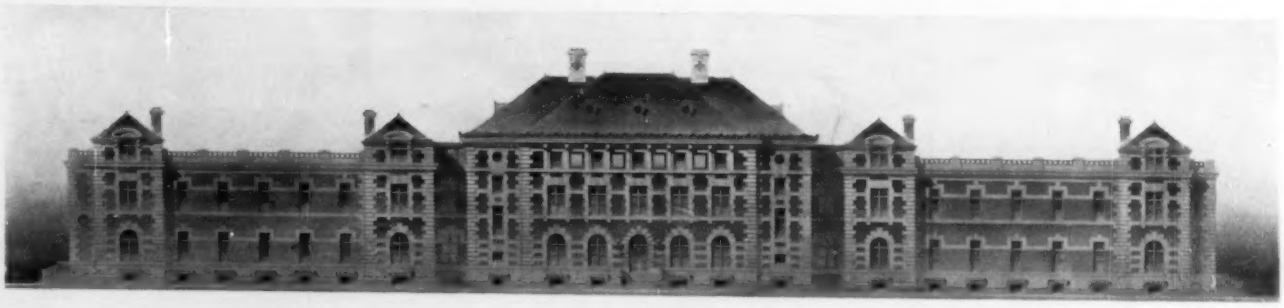
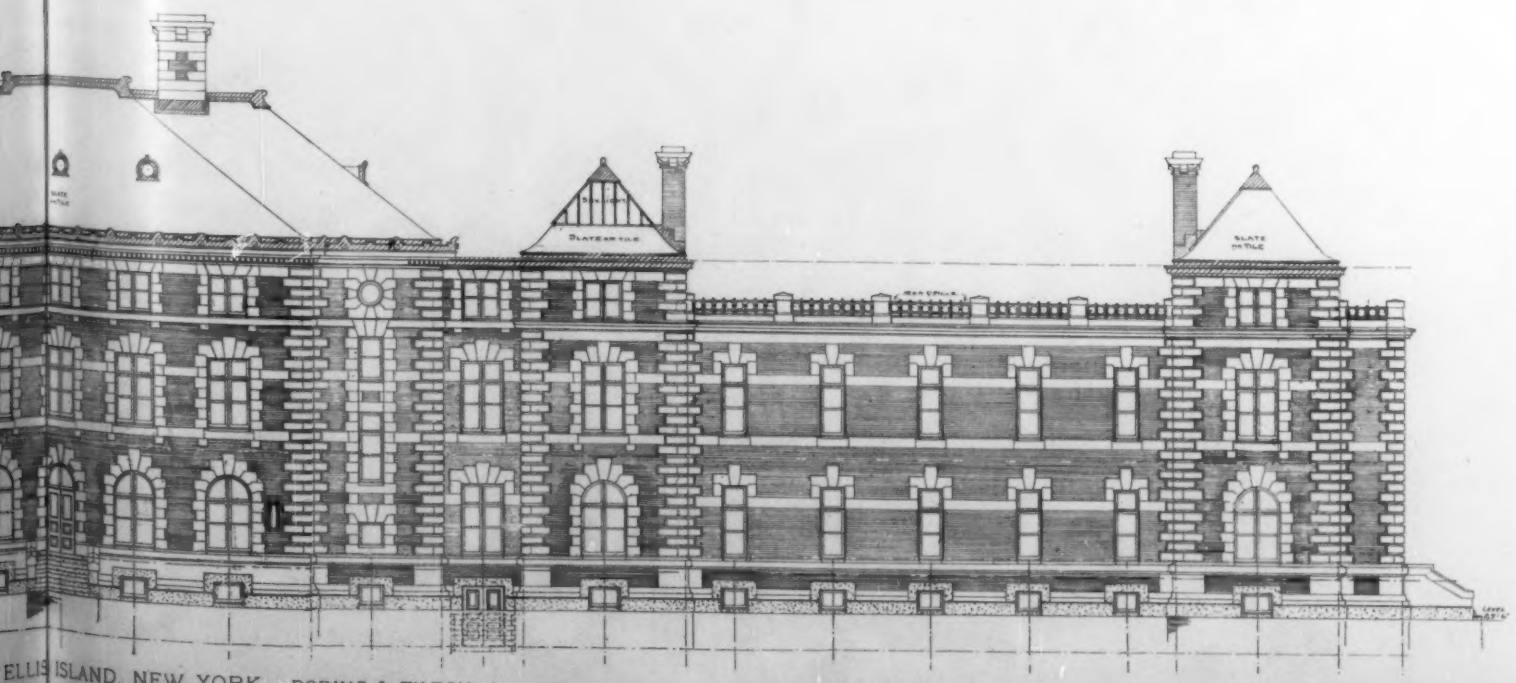


UNITED STATES GOVERNMENT HOSPITAL, ELLIS ISLAN

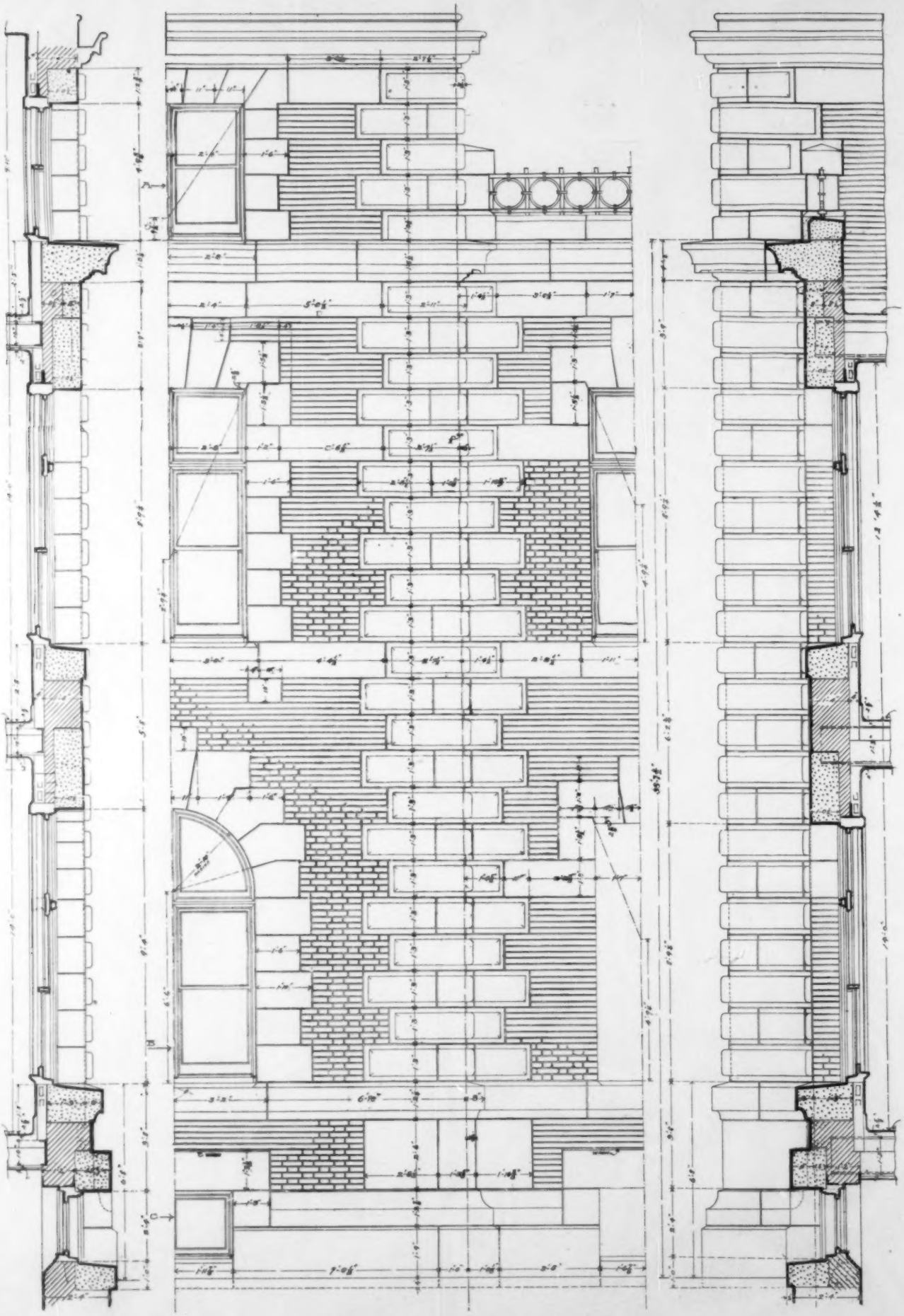




FRONT ELEVATION.



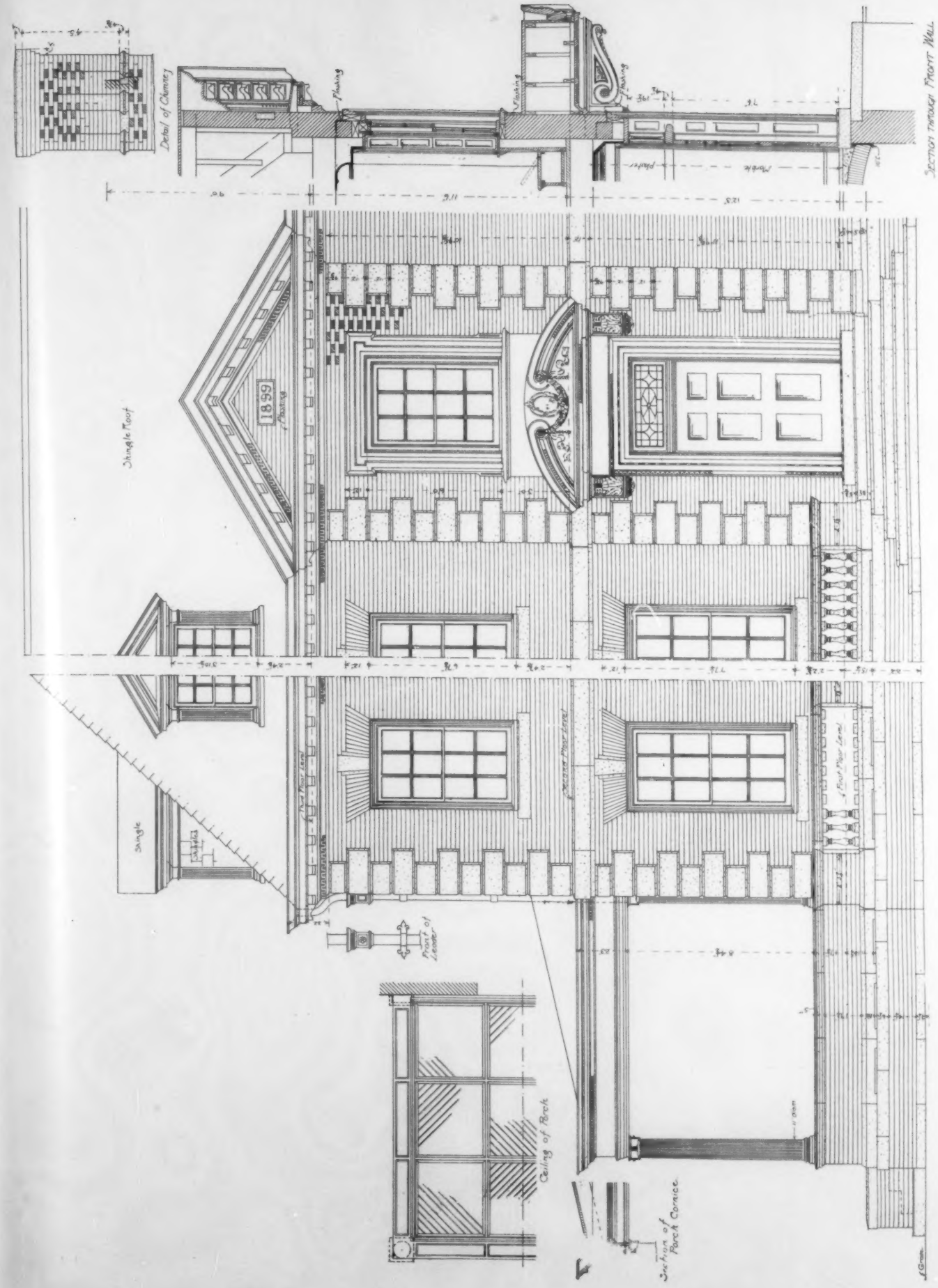
ELLIS ISLAND, NEW YORK. BORING & TILTON, ARCHITECTS.



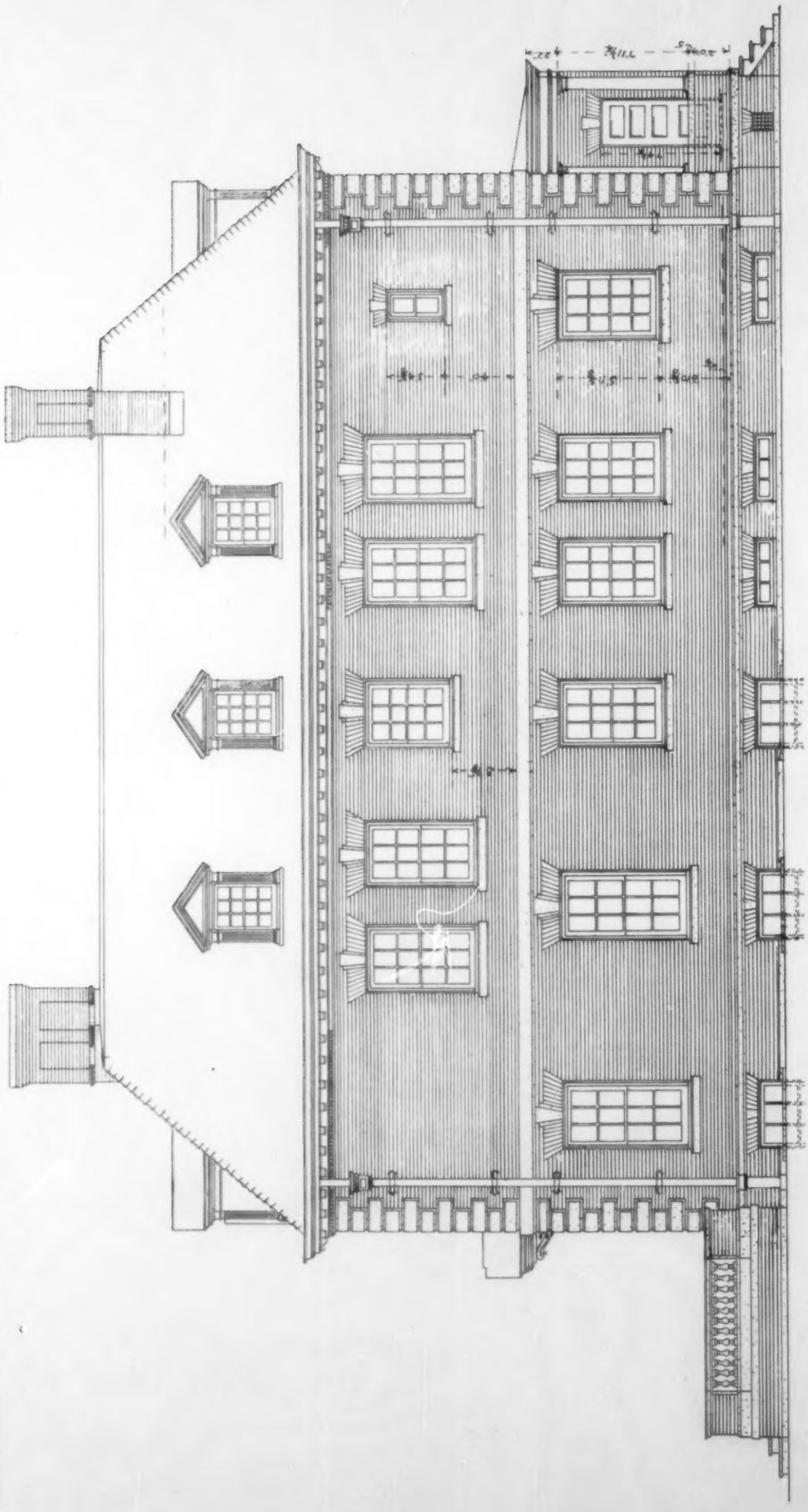
DETAIL, PORTION OF FRONT ELEVATION.

U. S. GOVERNMENT HOSPITAL, ELLIS ISLAND, NEW YORK.

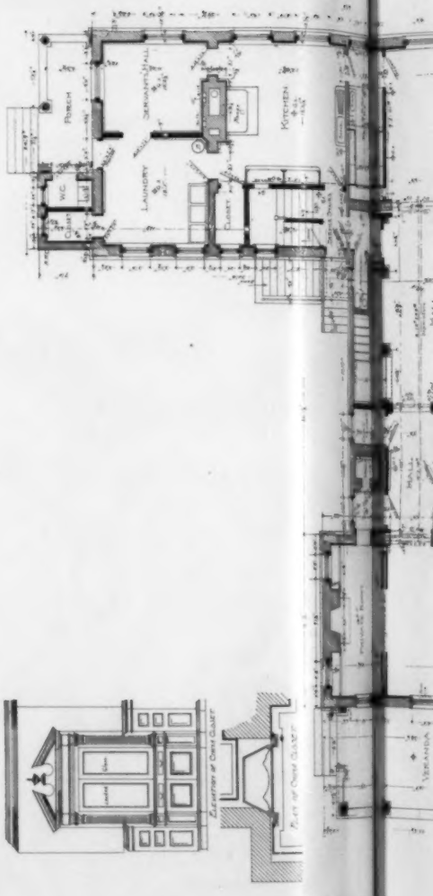
BORING & TILTON, ARCHITECTS.

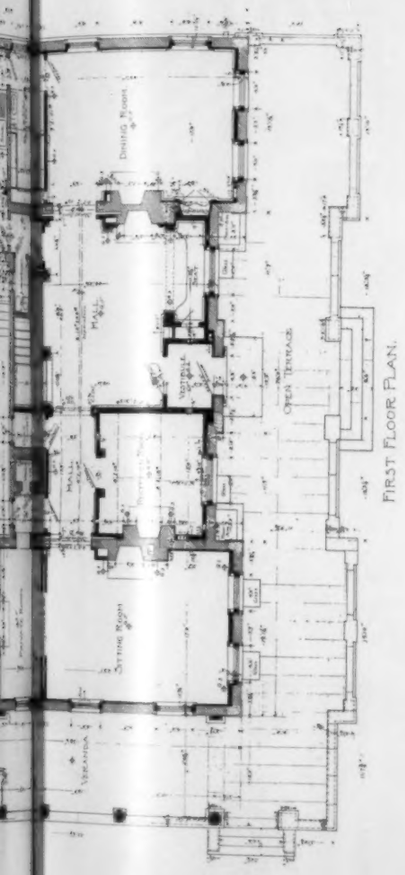


DETAILS OF FRONT ELEVATION.
HOUSE AT GERMANTOWN, PA.
RANKIN & KELLOGG, ARCHITECTS.

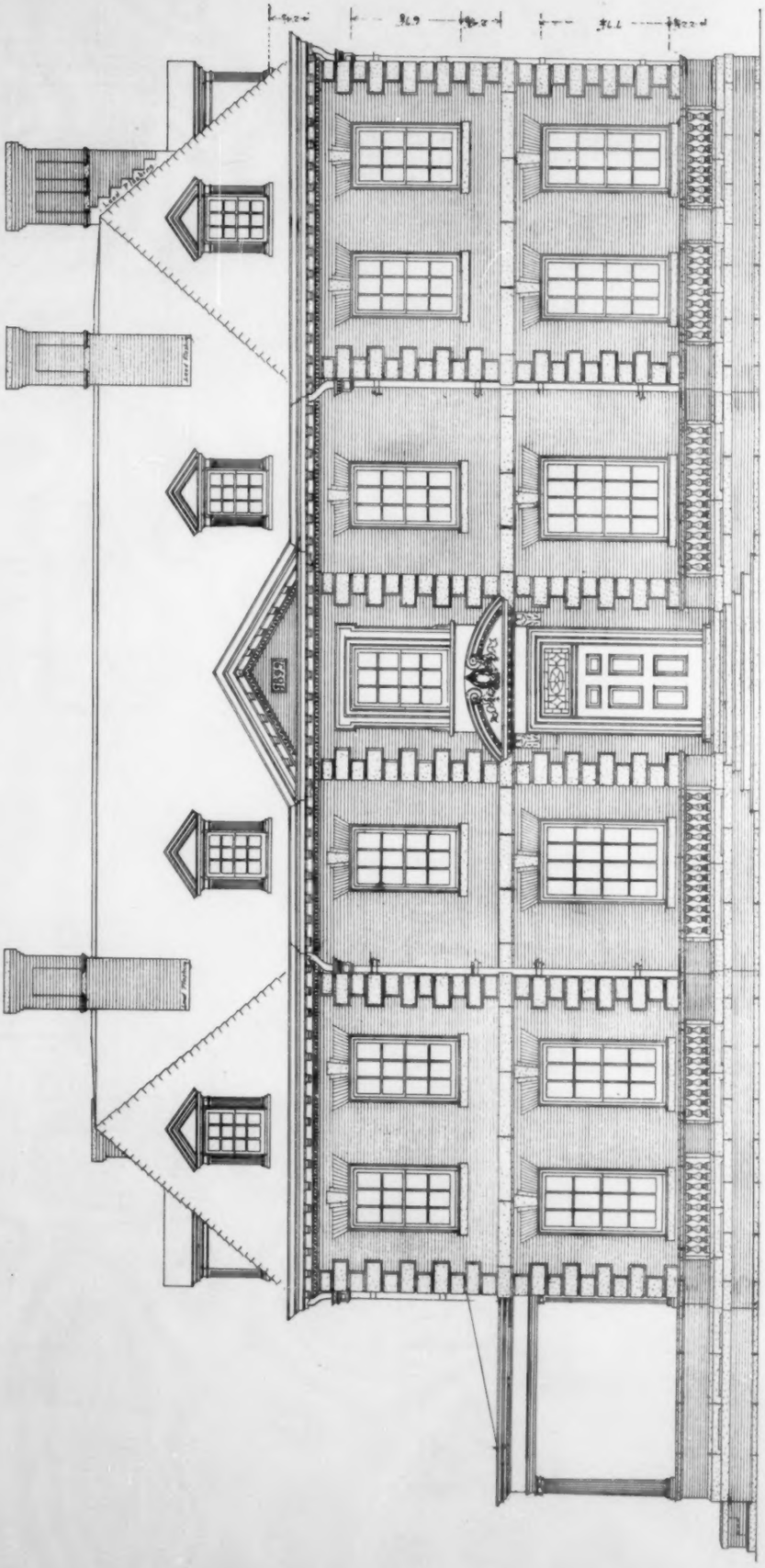


SIDE ELEVATION.





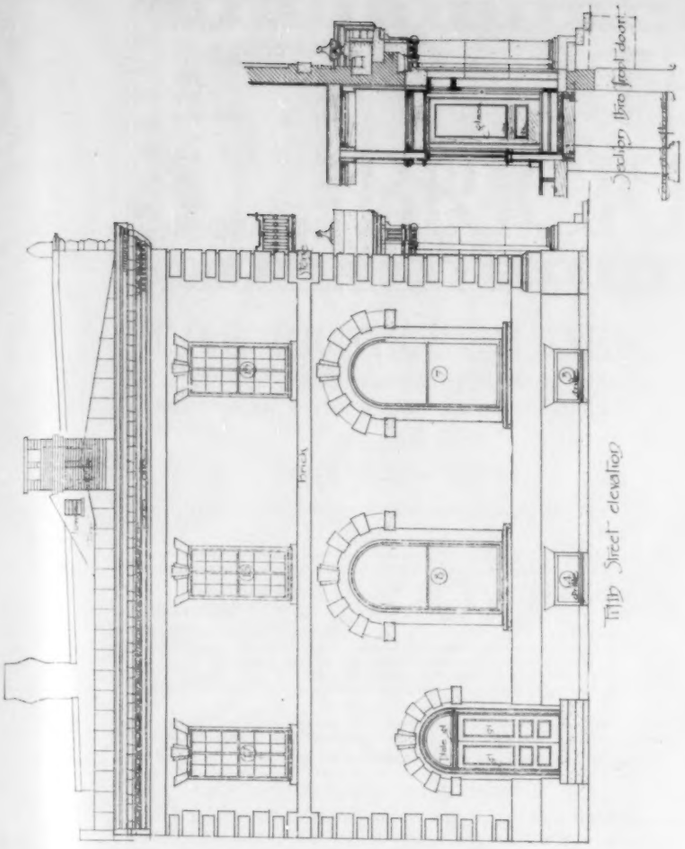
First Floor Plan.

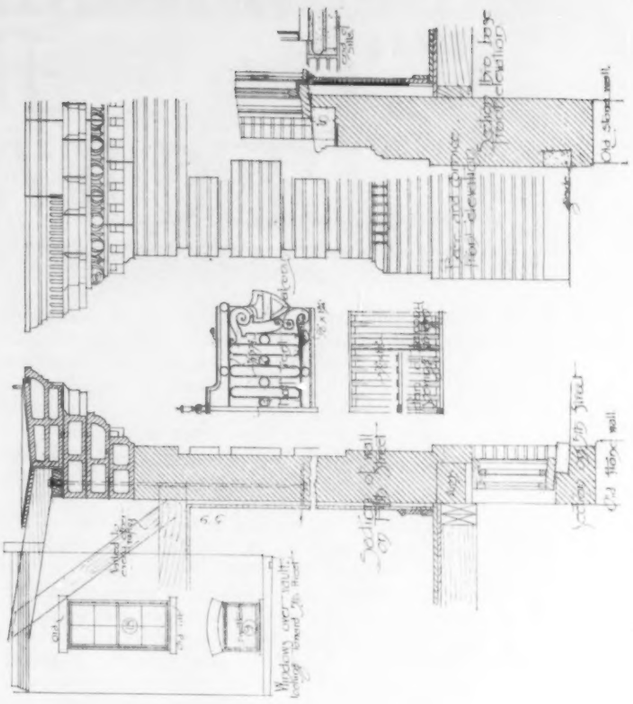


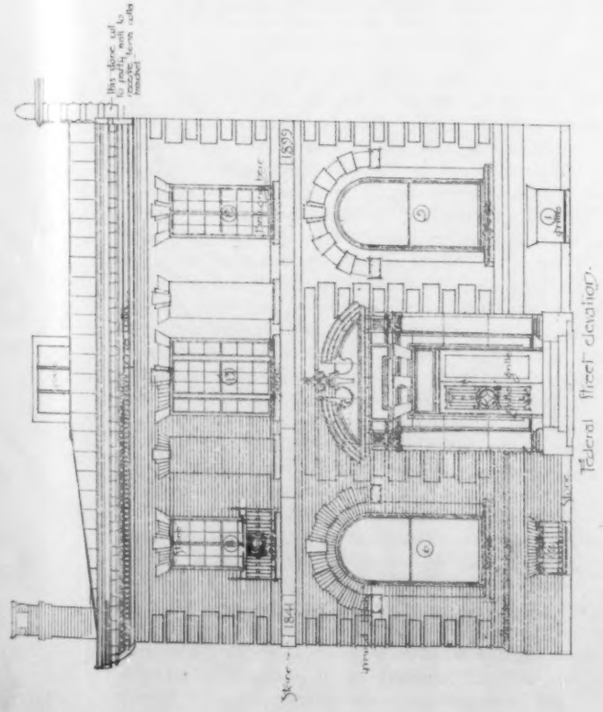
Front Elevation.

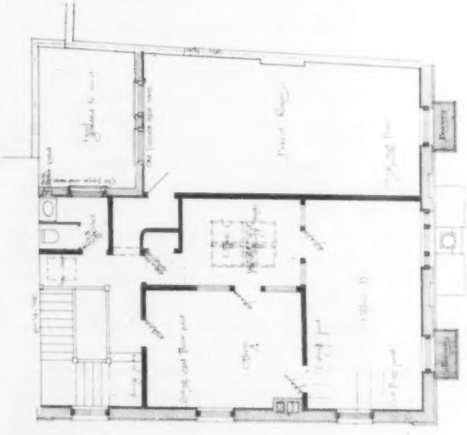
HOUSE AT GERMANTOWN, PA.

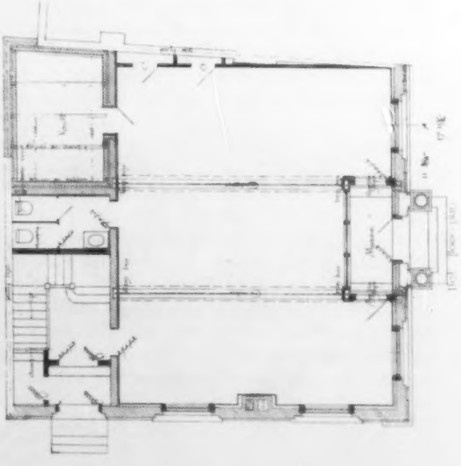
RANKIN & KELLOGG, Architects.











BUILDING FOR THE CAMDEN FIRE INSURANCE ASSOCIATION, CAMDEN, N. J.

BAILY & TRUSCOTT, ARCHITECTS.